MARCH 1950

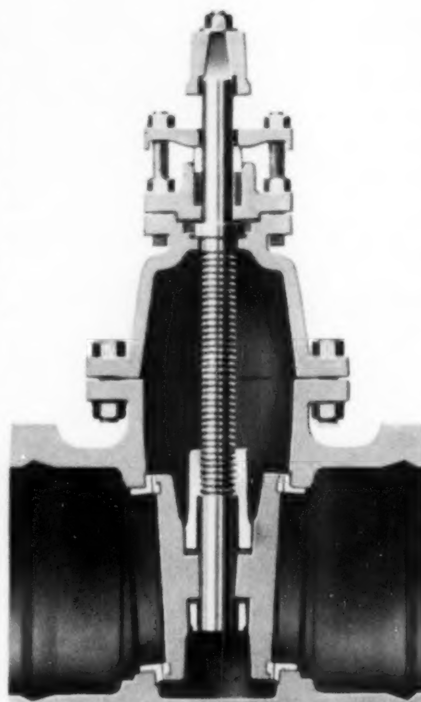
Journal

VOL. 42 • NO. 3

AMERICAN WATER WORKS ASSOCIATION

In this issue

A glance at the blueprint tells the story



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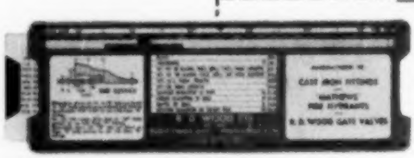

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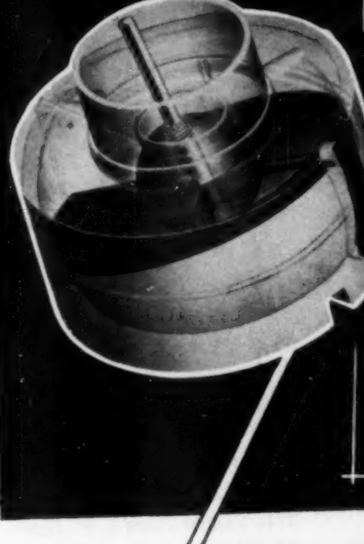

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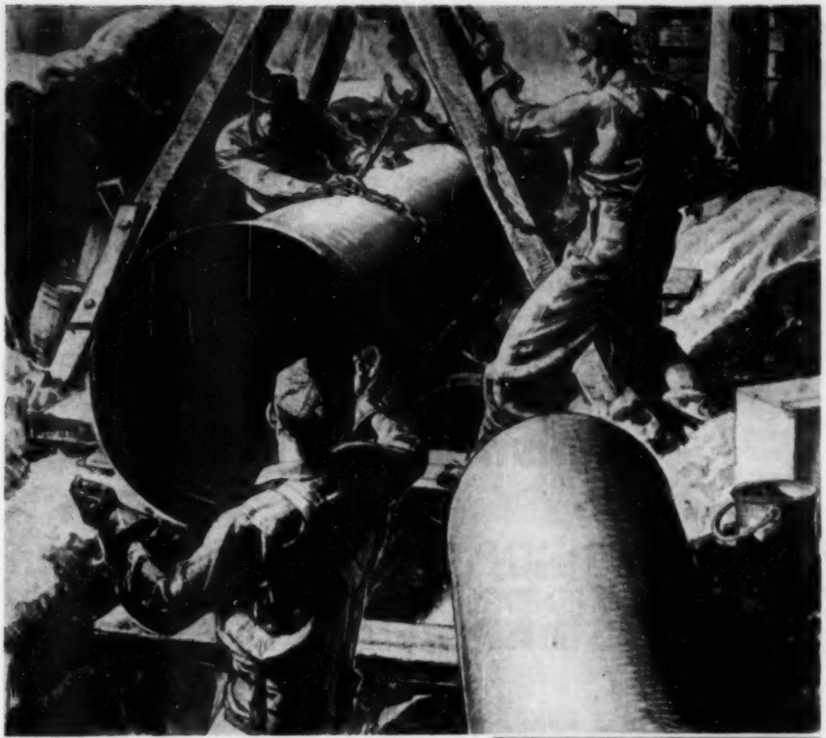

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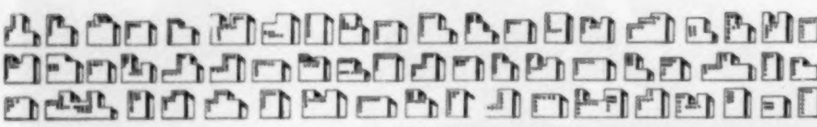

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31–Apr. 2—Arizona Section at Buena Vista Hotel, Safford. Secretary: Mrs. Helen Rotthaus, San. Eng. Div., State Dept. of Health, Phoenix, Ariz. Hotel reservation through Secretary, Chamber of Commerce, Safford, Ariz.

April 3–5—Canadian Section at General Brock Hotel, Niagara Falls. Secretary: A. E. Berry, Dir., Ontario Dept. of Health, Parliament Bldgs., Toronto 2, Ont.

12–14—Illinois Section at LaSalle Hotel, Chicago. Secretary: Carl N. Brown, Western Sales Mgr., U.S. Pipe & Foundry Co., 122 S. Michigan Ave., Chicago 3, Ill.

13–14—Nebraska in Lincoln. Secretary: J. W. Cramer, 922 Trust Bldg., Lincoln 8, Neb.

20–21—Kansas Section. Secretary: H. W. Badley, Repr., Neptune Meter Co., 640 Highland St., Salina, Kan.

21—California Section. Regional spring meeting in Santa Cruz. Secretary: W. W. Aultman, Box 38, LaVerne, Calif.

21–22—Montana Section at Florence Hotel, Missoula. Secretary: C. W. Brinck, Montana State Board of Health, Helena, Mont.

26–28—Indiana Section at Purdue Univ., Lafayette. Secretary: C. H. Bechert, Dir., Div. of Water Resources, Ind. Dept. of Conservation, 445 N. Pennsylvania, Rm. 200, Indianapolis 4, Ind.

May 11–13—Pacific Northwest Section at Hotel Winthrop, Tacoma, Wash. Secretary: Oscar P. Newman, Boise Water Corp., Boise, Idaho.

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Journal

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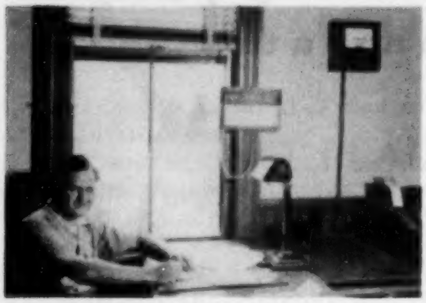

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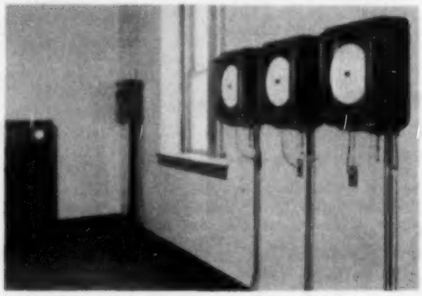
Wallace & Tiernan Residual Chlorine Recorder at Lake Whitney Filter Plant.



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Journal
AMERICAN WATER WORKS ASSOCIATION
VOL. 42 • MARCH 1950 • NO. 3

Regulations Governing Water Service

By W. C. Welmon, John C. Luthin and R. C. Kennedy

A panel discussion presented on Oct. 27, 1949, at the California Section Meeting, Sacramento, Calif., by W. C. Welmon, Secy. & Chief Acctg. Officer, Southern California Water Co., Los Angeles; John C. Luthin, Supt., Water Dept., Santa Cruz, Calif.; and R. C. Kennedy, Asst. Chief Engr. & Asst. Gen. Mgr., East Bay Munic. Utility Dist., Oakland, Calif.

Introduction

IT must be recognized that the rules and regulations of water utilities can never be made strictly uniform, since they must reflect local conditions as well as the historical background of the utility. Nevertheless, a greater degree of uniformity than now exists is generally agreed to be desirable. In the event of a dispute between the utility and a customer, the prestige of the Association behind a regulation would carry considerable weight, and it might not seem so unreasonable to a customer if he knew that other cities enforced the same conditions. Moreover, industries with branches in many places, and individuals who move from one locality to another, should find all utility rules and regulations roughly similar, just as they do traffic rules. Otherwise, they may properly be excused if they unwittingly violate them.

The authors do not claim to be experts on this subject, but they have had a good deal to do with compiling the rules and regulations for their respective organizations and have studied the more general problems in preparing this discussion. It is believed that the broad principles set forth herein are correct and should guide those responsible for preparing the regulations for their own communities. Criticism will, of course, be welcomed.

At the outset, there is an objection to calling these regulations "Rules and Regulations." These two terms are practically synonymous, and there is no reason for using both. Free people do not like an excessive suggestion of

control. A sign saying "Please do not walk on the grass" will obtain the maximum of compliance, whereas one reading "Keep off the grass—this means You!" will result in paths being worn through the turf. The authors therefore suggest the use of the title, "Regulations Governing Water Service," for all water utilities.

The purpose of printed regulations is twofold: first, to define the authority and responsibility of all utility employees in their relations with the consuming public; and second, to provide the consuming public with a written statement of the conditions under which water service will be furnished and continued by the utility. As the purchase of water from a common pipe system is a business transaction involving obligations to the utility and to others in the community, the conditions of service must be available for all to read.

The booklet containing the regulations should be handed to each new applicant for service, and he should be encouraged to read it. This practice may prevent a violation, which might go on undetected, and it will avoid the ill will that frequently results from enforcement if a violation is found.

This booklet need not be simply a compilation of warnings. It can be made interesting and informative if it contains also a brief description of the source of supply and the care used to insure the delivery of safe water; an explanation of water meters and how to read them; and, perhaps, a typical chemical analysis of the water. If the consumer is made aware of the purpose of the regulations, he will be more cooperative in doing his share toward following them. The booklet published by the New York City Dept. of Water Supply, Gas and Electricity, entitled "Facts and Regulations for Consumers of Water," is outstanding in presenting the subject in an attractive manner.

The general topic of this study has been divided into six logical parts, each of the authors taking two portions. The financing of main extensions, being a separate problem in itself, is not covered.

Requirements for Obtaining Service—*W. C. Welmon*

Normally, an application for service brings about the first relationship between the customer and the utility. It would seem natural, therefore, to begin with the subject of regulations affecting the requirements for obtaining service.

No attempt is being made to set forth regulations in the exact form in which they should appear for each water utility but rather to suggest the general concept and thought that should be contained in each regulation. The titles of the regulations under consideration are for the purpose of convenience and discussion, and the regulations as actually filed no doubt would incorporate several of the titles under one heading.

Definitions. The first regulation should set forth the terms and definitions which will govern the interpretation of the entire body of water works regulations.

Service area. The service area covered by the water utility should be defined by a regulation. For a municipally owned system, the area may be a political subdivision (city boundary lines) or the limits may be fixed by

ordinance. A privately owned utility, in California, operates under the jurisdiction of the Public Utilities Commission, which issues it a certificate of convenience and necessity. The area covered by this certificate should be set out in the regulation as the service area.

Description of service. The utility should state that it will endeavor to supply water in sufficient quantities and at adequate pressures to meet the reasonable needs and requirements of all applicants and customers. This regulation should also state the class, character and type of service which the utility is prepared to offer.

Application for service. Each applicant for water service should be required to sign an application form, provided by the utility, showing the date of application; the location of the premises and whether they have been served before; the date on which the applicant desires the service to begin; the purpose for which the service is to be used; an address for mailing or delivering bills; the applicant's status (owner, tenant or agent) on the premises; the class and size of service and the rate schedule desired, if optional service is in effect; and such other information as the utility may reasonably require.

The regulation should require the form signed by the applicant to state that, when two or more parties join in one application for water service, they shall be jointly and severally liable thereunder and shall be billed by means of single periodic bills. The form should also provide that a customer notify the utility 90 days in advance of any change which would result in a large increase in his use of water. In addition, the form should state that the utility cannot be held liable for damage arising from interruptions of service due to occurrences beyond its control.

Contracts. The regulations should provide that contracts need not be required as a condition precedent to service, except that contracts may be required when service is furnished under special rate schedules. The exception applies to main extensions, temporary service, standby or fire service, or cross connections with other qualified utilities.

Special information required on forms. The regulations should set forth any special information required for such forms as contracts, customer bills and deposit receipts. A contract of a privately owned utility must contain a provision that it is at all times subject to such changes and modifications as may be directed by the state public utilities commission. The customer bills should contain a statement that they are due and payable in accordance with certain regulations of the utility. Deposit receipts, of course, should show when the deposit is refundable and should state that it may be applied to unpaid balances if the service has been discontinued. The receipt should also note whether the deposit is to bear interest and, if so, at what rate.

Credit

Establishment of credit. The regulations should provide that each applicant be required to establish his credit before receiving service. In the author's opinion, credit is established if an applicant makes a cash deposit to secure payment of bills or if he has previously been a customer of the utility and has paid his bills promptly.

In California, the regulations under which the privately owned utilities operate provide that credit is established if the applicant is the owner of premises for which service is requested, or of other real estate within the company's service area, or if he furnishes a guarantor satisfactory to the company.

There is a difference of opinion regarding the proper interpretation of "ownership" of premises. Some feel that an applicant is not the owner unless he owns the property free of any lien. Others feel that an applicant could be considered the owner of record if he has as little as a $1,000 equity. Still others believe that any equity, whether $50 or $1,000, is sufficient to make an applicant the owner of record and to establish his credit.

The privately owned water company has no better means of securing payment of its bills from property owners than from property renters. The Southern California Water Co. has had several sad experiences with guarantors. Although the customer did not pay his bill, the company was unable to enforce payment by the guarantor. In the author's opinion, the ownership of real estate or the furnishing of a guarantor is not enough to establish credit.

Reestablishment of credit. The regulations should indicate the steps which a customer must take to reestablish credit after his water service has been discontinued because of nonpayment of bills. To reestablish credit, a customer should be required to pay all back bills, including those for water service up to the time of turnoff, plus a reconnection charge, if any. In addition, to secure payment of future bills, a cash deposit should be made, in accordance with the regulations concerning deposits.

Deposits

Deposits. The deposit necessary to establish the credit of an applicant, or to reestablish credit for a former or present customer, should adequately protect the utility against nonpayment of bills for the particular class of service rendered and yet be within reasonable limits so as not to impose any hardship upon the customer. For metered service, the deposit for other than domestic customers should be twice the estimated average periodic bill for the service, but never less than $2.50. For domestic customers, however, the deposit should be twice the minimum periodic bill, but again never less than $2.50. As flat-rate service is billed in advance, it is suggested that no deposit be required.

This regulation should also point out that, to reestablish credit, former or present customers would have to pay all back bills, including water service up to the time of turnoff, plus a reconnection charge, if any, in addition to the cash deposit.

Refund or disposition of the customer's deposit. Provision should be made to refund a deposit to a customer when he has, for twelve consecutive months, paid for service within fifteen days (on the average) after presentation of the bills. Upon discontinuance of service, the utility should refund the amount, if any, in excess of the unpaid bills for service. The utility should at any time have the right to apply the deposit, or any portion of it, to unpaid bills and to require the customer to replace the amount of the deposit so applied.

It may be noted that these suggested regulations have not mentioned interest on customer deposits. The present

regulations of the California Public Utilities Commission allow the payment of five per cent interest on deposits. The author, however, does not know of any municipally owned utility which actually pays interest on deposits, although there may be some that do. Since the money deposited must be available for refund to the customer at any time, the author feels that a deposit guaranteeing the payment of a customer's bill should not be considered as a loan to the company and subject to interest.

Other Items

Notices. The regulations should state where notices to customers should be mailed and where notices to the utility should be mailed. In emergencies, however, the utility should have the right to resort to oral notice by telephone or by personal contact.

Although it has not been included in the above regulations, some publicly owned utilities make a charge for turning on the water after the applicant has signed for service.

Installation of Service Facilities—*John C. Luthin*

Services on Public Streets

Many owners of large parcels of land having considerable depth will divide them into several smaller parcels, providing access to the rear lots by means of a right-of-way. These subdivisions are legal in California if no more than four such lots are sold. This practice permits the development of a tract of five lots if the owner retains one himself. These so-called subdivisions create many community problems, one of which is the installation of utilities. The access road is often temporary and its grade and alignment may later be changed, or it may even be extended through to another street.

A regulation which prohibits the utility from serving the portions of such subdivisions which do not face public streets simplifies the policy of extending mains and promotes an orderly development of the community. It offers difficulties, however, in communities where there is no ordinance which denies building permits to such property. If buildings are permitted on rear lots, they must be served from the nearest convenient point on a public street, resulting in long lines from the service to the customer's premises. Later the access road may become a public street and the utility may then be obligated to extend a main to serve the tract, thus causing the abandonment of the previous utility and customer facilities, with a financial loss to both parties.

A regulation which restricts main extensions for new customers to public streets should be adopted only if there is a local ordinance which similarly restricts building. The utility regulations should permit exceptions to be made where conditions are such that it is more advantageous to the utility to make the extensions.

Installation of Services

In temperate climates it is best for the utility to install the service from the main to the curb or property line, terminating with a curb stop and meter in a meter box. The facilities should be installed and owned by the utility. The house line from the meter or curb stop into the customer's property should be installed and owned by the customer.

In general, the size and location of the service is determined by the property owner, but services are sometimes installed as part of the improvements in new subdivisions or in advance of permanent pavement in order to avoid cutting it as the abutting property is developed. When several services are desired for a single property it is sometimes advantageous to the utility and property owner to have a single large service line from the main to the curb with branch lines or a manifold connecting to several services in adjacent meter boxes. Such arrangements are common and are acceptable practice if the meters are all side by side.

The California Public Utilities Commission has not accepted regulations which would permit privately owned water utilities to make a charge for service installations. Some publicly owned utilities make such charges, however.

The author believes there is a real justification for all utilities to charge for new service installations. The service benefits only the customer it serves, and he will readily pay the utility for the accommodation of having the service brought to his property line. If the utility pays the installation costs, the customer must pay in water charges for the privately owned utility's rate of return on that portion of its investment. Also, since publicly owned utilities pay most capital costs out of revenues, the water users are paying for the installations to serve new customers. Aside from the saving to both the utility and its customers, an installation charge has a salutary effect on the applicant, because, if he is required to pay for the service installation, he will be more careful in the selection of the size and location and will not be likely to apply for service unless he has a real need for it.

The most equitable type of regulation appears to be one which requires the applicant to pay a fixed charge approximating the average actual cost for each size of service up to and including 2 in. and the actual cost for larger services. The meter is not included as part of the service. Such a regulation is economically justified and consistent with good business practices. The regulation should also provide that the services shall be installed and owned by the utility.

Meter Installations

Meters should be placed at the curb or property line, and should be owned by the utility and installed at its expense. If a meter is removed at the termination of one occupancy, the reinstallation of a meter for a new customer should be done at the expense of the utility.

Number of Services on Premises

Some flexibility in the number of services allowed for each property is advantageous to both the utility and the property owner. Properties which have several buildings or occupancies with separate tenants can best be served by individual services to each tenant, except for apartment houses or other large multiple dwellings so arranged that it is not economical or feasible to have separate house lines to each occupancy. Separate services permit the owner to have each tenant pay for his own water use, which makes him more cognizant of leaks and wasteful habits. The utility gains by having each tenant pay the monthly minimum or service charge, while the water rate falls in the

higher brackets. Other, less frequent requests for more than one service per property come from extensive industrial plants or other enterprises which find that it is more convenient and requires less plant piping to have several separate connections to the utility's supply.

Whatever the reason for the request, the utility should agree to any reasonable number of services installed at a property if they are all to be put to active and permanent use. Again the question of who pays the service installation costs will have some effect on the desirability from either the utility's or the customer's standpoint.

The regulations should provide that the owner may apply for as many services as he and his tenants require. If the utility does not charge for service installations, however, it may be necessary to place some limit on the number of services.

Supply to Separate Premises

A regulation limiting each service to a single property is designed to prevent the use of a single service by several adjoining pieces of property all under one ownership but having separate occupancies, or by several customers who join together to take advantage of the single minimum charge and the large-quantity rate. Sometimes, to avoid having to make a deposit for a main extension, persons will extend a line from an existing service to another piece of property which does not have a water main adjacent to it.

There might appear to be some inconsistency between a regulation which limits the extent of property to be allowed under one service and one which permits an owner to apply for as few or as many services as are desired for a single property. Although the customer who pays for the service should be the person most interested in having everyone served individually, he cannot always be depended on to take this attitude. There must be some means whereby the utility can prevent conspiracies for obtaining water service at lower rates than were intended in the application of the rate schedule.

The regulation should limit the use of water from a service to a single property. The interpretation of "single property" presents some difficulty, however. In general, a lot or parcel under one ownership is a single property except where there are well defined boundaries such as fences, hedges or other restrictions preventing the common use of all of the property by the several tenants. The regulation against making a connection to an existing service to avoid payment for a main extension is the most troublesome to enforce, because it often inflicts a hardship on a family which has built a home without knowledge of the rules affecting water service. One satisfactory means of serving this type of customer is to install a service at his expense on the nearest main and require him to obtain the necessary rights to cross any intervening properties.

Resale of Water

There are several types of resale of water. The first involves the prorating of charges among several tenants on a single property served jointly through one service connection. This practice is forbidden by many utilities, but the prohibition is difficult, if not impossible, to enforce. Eventually, however, an owner who attempts such resale runs into trouble and must either pay the charges himself or have separate

services installed. Moreover, it is questionable whether the practice is harmful to the utility, since the owner, as the applicant, is responsible for the payment of the cost of service and can, if he so chooses, pay the bill himself without passing the charges on to the tenants.

The second type of resale involves the use of a single service for several premises, through either the direct resale of the water or the prorating of charges among the several parties. This procedure is an evasion of the rate schedule, and there are several justifiable reasons for prohibiting it. As rates are based on certain assumed utility-customer relationships, an adjustment would be required if the practice of group services became widespread. The utility has the right to control the conditions under which service, subject to a particular rate schedule, will be rendered. If several premises are supplied by a single service, the utility could multiply the minimum charges and quantity block rates by the number of separate properties connected to the service. The utility should be privileged to serve its customers as best fits into an orderly manner of doing business. Permitting the resale of water by the customer complicates records and adds to the work and the cost of utility operation.

The two types of resale mentioned above can be controlled by a regulation limiting the service to a single property. The resale of water to a group of customers at rates designed to bring the owner more than the actual cost places him in the public utility business, subject to the jurisdiction of the public utilities commission, and need not be controlled by utility regulations.

The purchase of water by another utility for resale is generally handled by contract or other special arrangement and does not have to be covered by the utility's regulations.

Changes in Meter Location

Requests for relocation of meters are generally made for the purpose of removing the meter and box from a proposed driveway or to prevent interference with landscaping or other use of the property. The relocation of a meter and box may be accomplished either by extending the service parallel to the curb or property line for a sufficient distance or by installing a new service at the desired location. It is preferable to restrict the lateral distance for relocation of the meter or meter box to perhaps 5 or 6 ft.

There is also a question whether the meter is being moved for the protection of the utility property or for the convenience of the customer. If the customer is always to be charged for the relocation, he may build his driveway around the meter box and leave the problem of protecting the meter and box to the utility. On the other hand, if the relocation is for the convenience of the customer, it seems only fair that he should be required to pay the costs.

It would appear to be reasonable to have a regulation which provides that the utility will bear the cost of relocating a meter and box to protect its own property, but that the customer must pay the cost if the relocation is for his own convenience. There should be some limit to the lateral distance which a meter and box will be moved, a new service being required at the desired or safe location if this maximum is exceeded.

Changes in Meter Size

If there is any question in the mind of either the utility or the customer on the size of the service installation to a property, the utility should survey the needs and make a specific recommendation as part of its customer service. Whether or not such a survey is made, the customer has the privilege of selecting the size of service and meter he wishes, if his choice is within reasonable limits.

After the service has been installed, the customer or his successor may, as an economy measure, desire to have the meter size changed. There are several reasons for such requests. A permanent change may take place in the property or customer requirements, such as a shift from agricultural to residential use. The seasonal water demand may vary greatly, so that the customer would find it advantageous to alternate between a large and small meter from time to time. Occasionally a customer orders a meter somewhat smaller than the size of the service to gain the double advantage of increased flow capacity and reduced monthly costs.

The utility must protect itself against seasonal or repeated changes which are time-consuming and expensive and against excessive wear on meters subjected to rates of flow in excess of the design limitation. The latter can be controlled by using fittings small enough to restrict the flow through the meter to the range for which the meter was designed. The number of requests for seasonal changes depends somewhat on the differential between the minimum or service charges for different sizes of meters. A small differential has the beneficial effect of reducing the number of meter size changes made for the sake of economy but is detrimental because it encourages requests for larger meters than are actually needed, resulting in an increase in the utility's investment in the customer service. Another means of avoiding repeated changes is to reduce the minimum or service charge during the off seasons, without changing the meter size. This practice, however, is discriminatory and difficult to administer.

Perhaps the best method of controlling these requests is to make one change a year free but to charge a fixed amount for each additional change in any twelve-month period.

Change in Service Location

Requests for a change in service location fall into three groups. Services are sometimes installed before construction in new subdivisions and in advance of paving streets in order to serve each lot and avoid later disturbance to the pavement. The use to which the property is eventually put may require the relocation of the service, or lots may be combined or divided, making the previous service location undesirable. Changes for improvements on the customer's premises may make it desirable to move the service to a location so far distant from the existing service as to require the installation of a new one. The division of a parcel already receiving service into two or more parcels may necessitate installing a new service for the original house or building. Quite often a parcel bounded by streets on two or more sides is so divided that the original customer's service line

crosses property which he no longer owns, obliging him to obtain service from the street his property faces.

If the utility charges for the installation of all new services, there is no controversy or abuse of the customer's privileges and no regulation for changing the location of service is necessary. If the utility does not charge for the original service at a property, it should have a regulation establishing a means of charging for new services installed at properties for which service had previously been provided.

Meter Reading, Billing and Accounting—*W. C. Welmon*

Of the various regulations under which the water utilities operate, those relating to meter reading, billing, payment of bills and customer accounts are the most frequently used. When the applicant has met the requirements for obtaining service, he can be considered a customer of the company. In each billing period thereafter, the company must read the water meter, prepare the bill and take the necessary action to assure the collection of the account. The following provisions are suggested under the general classification of "Regulations Relating to Meter Reading, Billing, Payment of Bills and Customer Accounts."

Billing and Payment

Meter reading. As it is not always possible to read meters on the same day of each month, the regulations should provide that, if a monthly billing period contains less than 27 or more than 33 days, a pro rata correction in the bill will be made. Of course, if the utility is billing on a bimonthly basis, the number of days should be changed to 54 and 66, respectively.

Billing period. A regulation should provide for the period to be covered by the bills; that is, whether they should be rendered monthly, bimonthly or as otherwise provided in the rate schedule.

Opening and closing bills. The opening and closing bills for less than the normal period should be prorated. For metered service, however, when the actual use is greater than the monthly minimum charge, the opening or closing bill should be based on actual consumption. This regulation should also provide that if the total period of water service is less than one month, the water bill should be not less than the monthly minimum charge.

Payment of bills. The regulations should state when bills are due and payable and the period of grace allowed before service will be discontinued for nonpayment. Bills should be payable upon presentation and not more than fifteen days of grace should be allowed before service is discontinued for nonpayment. Metered bills are presented after the service has been rendered, while flat-rate bills are submitted on the first day of the period covered. This regulation should also provide that, when bills are delinquent, the utility may demand payment of the full amount not only of the delinquent bill but of the current monthly bill as well.

Billing of separate meters not combined. All meters supplying a customer's premises should be billed separately, except that, where the utility, for operating purposes, has installed two or more meters in place of one,

the readings should be combined for billing.

Disputed bills. When a customer disputes the correctness of a bill for water service, the utility, if subject to commission jurisdiction, should notify the customer, in writing, that he may deposit with the commission the full amount of the disputed bill to preclude the shutting off of service pending final settlement of the dispute by the commission; provided, of course, that subsequent bills are paid to the utility or placed on deposit with the commission. Failure of the customer to make such deposit within ten days after notice is given would warrant discontinuance of his water service without further warning.

Meter Accuracy

Meter test. Every new meter should be tested prior to installation and no meter should be placed in service if found more than 2 per cent inaccurate. The regulation should also provide that a customer may, upon not less than five days' notice, require the utility to test the meter serving his premises, but that he may be required to make a deposit to cover the reasonable cost of such a test. The amount of the deposit would be based upon the size of the meter—the Southern California Water Co. requires $1.00 for a meter 1 in. or smaller, and $2.50 for larger ones. Such a deposit would be refunded to the customer if the meter were found to overregister more than 2 per cent; otherwise, the deposit could be retained by the utility. The present regulations of the California Public Utilities Commission provide that the customer has the right to require the utility to conduct the test in his presence or in the presence of his representative. Some utility operators feel that the presence of the customer or his representative should be required to assure the customer's satisfaction with the accuracy or completeness of the test. The regulation should also provide that a written report of the test be given to the customer within a reasonable time after its completion.

Most utilities test their meters at three rates of flow, the problem then being which to use in the report to the customer. Some states provide in their regulations for a weighted average of the various flows taken to determine the average accuracy of a meter. It is suggested that the average accuracy be determined by giving a weight of two for the test having a rate of flow nearest that at which the largest portion of the water is used, and a weight of one to the other two rates of flow. For example, assume that a $\frac{5}{8} \times \frac{3}{4}$-in. meter is tested at 0.25, 2 and 12 gpm. If it is estimated that there is more water going through the meter at the rate of 2 gpm. than at the other two rates, the percentage of accuracy for the 2-gpm. rate of flow would be given a weight of two, and the percentage of accuracy for the 0.25- and 12-gpm. rates would be given a weight of one each. The method of computing the weighted average percentage of accuracy would be as follows:

Flow Rate *gpm.*	Accuracy *per cent*	Weight	Product: Weight × Percentage
0.25	99.2	1	99.2
2	99.4	2	198.8
12	98.0	1	98.0
Total		4	396.0

The weighted average percentage of accuracy, $396.0 \div 4 = 99.0$, is the fig-

ure that would be used in the test report given to the customer.

Adjustment of bills for meter errors. If, upon test, a meter is found to be overregistering more than 2 per cent, the utility should refund to the customer the amount of the overcharge, based on corrected meter readings. Also, under this regulation, when a meter for domestic service is found to be registering less than 75 per cent of actual flow, or a meter for other than domestic service is registering less than 95 per cent of flow, the utility could bill the customer for the amount of the undercharge, based upon corrected meter readings. In any event, the adjustment for either an overcharge or an undercharge should be for the period in which the meter was in use, but not exceeding six months, unless it can be proved that the cause of the error occurred prior to the six-month period.

Nonregistering meters. One of the problems of every utility is billing for nonregistering meters. A regulation should provide that, when a meter has become nonoperative, the utility may use the consumption for the previous year in computing the amount of the bill. If there was no service in the previous year, the utility would, for domestic service only, bill the minimum, for the months of November, December, January and February. For other months in the year, and for service other than domestic, a six-month average would be used.

Discontinuance of Service

Discontinuance of service for nonpayment of bills. Service should be discontinued if a bill is not paid within fifteen days after presentation; if a bill for water service furnished at a previous location is not paid within fifteen days after presentation at the new location; or if, when a customer receives water service at more than one location, a bill for service at any one of the locations is not paid within fifteen days after presentation. In the latter instance, water service may be turned off at all locations. Service should not, however, be discontinued until the amount of the deposit, if any, has been fully absorbed. Domestic service should not be discontinued because of nonpayment of bills for other classes of service.

Normally, when an applicant applies for service, his bill for service at a previous location would be paid when he reestablished credit. If he did obtain service without paying such bill, however, the collection of the account would be handled as mentioned above.

Discontinuance of service for unsafe apparatus. The utility should have the right to refuse to furnish water and to discontinue water service to any premises where any apparatus or appliances using water are unsafe. The regulation should also provide that the utility will not assume the duty of inspecting the customer's apparatus, appliances or equipment, and will assume no liability therefor. The utility should, however, reserve the right to inspect the customer's property if there is cause to believe that such unsafe apparatus may be in use.

Discontinuance of service because of conditions detrimental to other customers. Certain conditions, while neither unsafe for the customer nor hazardous to the general public, may adversely affect the service to other customers—for example, noises originating in the lines on the customer's premises and telegraphed over the lines to the services of other customers, or excessive

demands on the existing distribution facilities resulting in inadequate service to others. The utility should reserve the right to refuse or curtail service, under these or similar detrimental conditions, until they are corrected.

Discontinuance of service for fraud or abuse. The utility should have the right to refuse or discontinue water service to any premises if necessary to protect itself against fraud or abuse.

Discontinuance of service because of noncompliance by customer with utility regulations. If a customer does not comply with the utility's regulations, the utility should have the right to discontinue water service after at least five days' written notice.

Discontinuance of service on vacating premises. A customer may have his water service discontinued by giving notice of his desire not less than two days before the effective date of discontinuance. The customer should be required to pay all water charges until the effective date stated on the notice.

Other Regulations

Other regulations that might be given consideration are those concerning standby charges and unpaid water bills as a lien on property.

With a standby charge, the utility could continue to receive revenue from a service that had been disconnected during a period when the customer was away. Such a charge may not be as large as a normal minimum bill but would represent some return to the utility for its investment in the service and meter. Of course, it may be that the lack of revenue due to a disconnection could be remedied by a turn-on and turnoff charge.

It is evident that a regulation making unpaid water bills a lien on property would be applicable only to a publicly owned utility. This regulation would, of course, be of great assistance as it should eliminate practically all uncollectible accounts. It could, however, be considered unfair to a property owner, since he, of course, would be liable for any unpaid water bills that his tenant might leave behind.

One problem that cannot be covered in a regulation is adjustments on account of high bills. Theoretically, any water that goes through the meter would be a proper charge to the customer. A leak, however, may have occurred in the connection from the meter to the customer's property, which could be the utility's responsibility rather than the customer's. Therefore, a proper adjustment should be made. Where there are leaks in the plumbing facilities on the customer's premises, there is no reason why the utility should make an adjustment, but custom and good public relations usually dictate that the customer receive credit for half the excess over his normal use.

Special Types of Service—*R. C. Kennedy*

Private Fire Services

In general, private fire services are installed only by industries, large commercial establishments, hotels and other sizable institutions. Their purpose is to save insurance cost and prevent the loss of use of the property, by extinguishing fires quickly. Usually an alarm outside the building announces the flow of water from automatic sprinkler heads, and, in large cities, the American District Telegraph serv-

ice is also automatically alerted so that the fire department can be notified. The result is a very favorable fire and water damage risk.

The water utility is usually not well compensated for the great value of the fire service, but, on the other hand, the additional cost to the utility is small. In practically all cities, the applicant is required to pay all the costs of installation, and thereafter the monthly charge is generally nominal.

Where elevated tanks or pumps also supply water to the automatic sprinklers, a danger of backflow into the water mains exists, and precautions against contamination must be taken. Since the connection is large, the water can flow back at a high rate if not properly checked. It is recommended that a check valve should always be used, and, where a foreign source of water can in any way be made available to fire department pumpers or other fire-fighting apparatus, approved double check valves or equivalent devices should be required.

A meter to detect minor flows is essential on each private fire service in order to discover unauthorized use and also to show leakage, which is likely, especially where much outside piping is installed in the protected property. The common "detector" type of meter incorporates a check valve together with a small-flow bypass meter. If any flow exists greater than might be expected from minor leaks, the service should be discontinued.

The general items which should be covered by the regulations for private fire services are listed below:

1. There should be a special agreement setting forth the limitations on use, with violation to result in discontinuance of service.

2. The size of the installation should be not less than 4 in. and it should be approved by the underwriters inspection bureau or the fire department before the service is turned on.

3. When there is more than one fire service on the premises, each is to be protected from reverse flow by a check valve.

4. No private fire service is to be installed unless a water service for general supply also exists on the premises.

5. No consumption should be permitted except for extinguishing accidental fires.

6. Double rates should be charged for water use recorded on the meter, but no charge is to be made for water used to fight a fire.

7. All private fire services are to be metered, the meter to be a bypass check valve type.*

8. All installation costs are to be paid by the applicant.

9. Equipment is to become the property of the utility.

10. The monthly charge should be sufficient to pay for standby cost plus meter reading, billing and similar expenses.

11. The utility should not be responsible for maintaining fixed pressure, volume or supply. The service is subject to shutdowns and variations as required by the operation of the system.

12. Water for testing, filling or washing tanks is to be taken from the general supply service.

Temporary Service

A temporary service is one which by its nature is to be of limited duration. Generally, the period may be

* See A.W.W.A. Specifications for Cold-Water Meters—Fire Service Type—7M.4-1949.

taken as one year, although the amount of consumption expected has a bearing on this point. A construction job service is usually regarded as temporary, even though the work is planned to take perhaps two years. On the other hand, a cannery water service, although used seasonally, is ordinarily classified as permanent.

Applicants for temporary service are properly charged for all costs of installation, as well as for removal of the service. Since unnecessary taps into the mains are undesirable, the use of fire hydrants is preferred, although removal of the connection may cause delay to the fire department in emergencies.

The regulations covering temporary services should include the items listed below:

1. The service should be limited to construction, temporary irrigation, circuses, supply to ships and similar uses of definitely temporary nature.

2. All standby and consumption rates should be the same as for permanent service.

3. The applicant should pay in advance the estimated cost of installation and removal of metering and other equipment. Refund should be made for salvaged material when the service is removed.

4. The applicant should pay in advance the estimated cost of the water to be used, or he should otherwise establish credit.

5. If the service is attached to a fire hydrant, fire department approval should first be obtained by the applicant. The hydrant valve should never be used to control the flow.

Swimming Pools

Except for precautions against the possibility of overdraft from small storage—which might result in depriving other consumers of water—and perhaps the burning out of pump motors, few special regulations are required for swimming pools. Owners should be required to notify the utility before filling the pool. The service should be of a size commensurate with the capacity of the distribution main and the storage facilities. Hoses should not be permitted to lie over the pool edge, and the inlet should be at least 6 in. above the overflow.

For simplicity, filters are sometimes so constructed that the backwash water is taken directly from the service pressure. This practice could result in siphoning water from the filter into the street main and should not be permitted.

Use of Fire Hydrants

Violations of regulations concerning hydrants are probably the most common nuisance to water utilities. The construction of a hydrant valve is such that it may chatter violently if used in a slightly open position, sending vibrations and noises back through the mains that are annoying and may cause serious damage to plumbing. Such a nuisance recently caused a separation of pipes in an upstairs bathroom in Oakland, Calif., and the water damage to floors and rugs resulted in a serious loss. No person other than a properly instructed city or utility employee should be permitted to operate a hydrant valve unless a reducer with a control valve is first attached.

Hydrant valve stems are damaged by use of a Stillson type wrench, and such practice should be forbidden.

Leakage from temporary connections to hydrants causes softening of the ground and hence weakens the hydrant, as well as resulting in unsightly

rust stains. Users should be required to maintain tight connections.

Moving of Hydrants

The development of driveways, particularly into corner gasoline stations, frequently makes necessary a change in the location of a fire hydrant. Assuming the hydrant to have been properly located, all the costs of such a move should obviously be borne by the party desiring the relocation.

Flat Rates for Construction Work

Flat rates are regarded as undesirable for all special types of service, since there is then no incentive toward economy of use or prevention of wastage. Under some circumstances, however, it is not practical to meter the water used, particularly where trenches are settled by inundation and the water is drawn from numerous hydrants along the line, or where a concrete mixer uses water as it is moved along a trench. The quantity of water assumed for such uses should be generous to allow for wastage and the other purposes for which it will also be employed. Standard rates should then be applied to these assumed quantities.

Use of Service—*R. C. Kennedy*

Responsibility for Equipment

In the warmer parts of the country, utility equipment is generally placed within the dedicated street area, except in commercial and industrial districts where the meter must frequently be located in basements or on private grounds. The regulations governing water service should contain provisions covering the latter conditions in order that there may be no question about responsibility.

1. Utility equipment on the customer's premises remains the property of the utility and may be repaired, replaced or removed by the utility without consent at any time.

2. No payment is to be made to the property owner for the right to place and maintain equipment on his premises.

3. The property owner must exercise reasonable care to prevent damage to equipment, and must in no way interfere with its operation.

4. The property owner should keep vicious dogs secured or confined to avoid interference with utility maintenance.

5. The property owner should furnish a key for access to indoor metering equipment if the building is frequently unoccupied, and he should maintain the meter free from rubbish or other material which may obstruct access by utility employees.

Damage to Utility Property

There should be provisions for payment by the customer for damage to utility property, whether on his premises or not. The most frequent damage is that caused to the meter by hot water or steam flowing back through it.

1. The customer is liable for any and all damage to utility property if caused by him or his agent, employee and the like.

2. Damage includes breaking of seals or locks, tampering with the meter, or injury from backflow of hot water or steam.

3. Payment for damage must be made promptly upon presentation of a bill therefor.

Control Valves

City plumbing ordinances usually contain a provision requiring a control valve between the meter and the building. As this requirement does not cover outside-city services, the regulations should require such a valve and should prohibit the operation of the utility curb stop by unauthorized persons.

Cross Connections

The ever present menace of polluted water passing back through a meter has received much attention from water utilities and state boards of health, especially in recent years. The danger exists in most industries and in all waterfront areas. Ships at dockside must keep water under pressure for fire prevention purposes. The water is usually drawn from the harbor and is at a pressure greater than that commonly carried in water mains. An error in operating a valve or the existence of a faulty valve can cause pumpage of the polluted water in large quantities directly into the distribution mains. Although the matter is covered in the Drinking Water Standards of the U.S. Public Health Service and in most state laws, it should be fully set forth in the regulations as well. The recommended provisions are as follows:

1. No unprotected cross connection is permitted between a public supply and any other source.
2. The approved installation of double check valves with proper testing facilities is required where a cross connection exists. Check valves are to be adjacent to the meter.
3. The existence of any other source of water, or of industrial liquids on the premises, may be a cause for requiring backflow protection.
4. All waterfront properties having fresh-water outlets or fire hydrants within reach of the dock or pier must have backflow protection.
5. The utility should require plumbing changes on the property before granting service where special hazards of backflow of dangerous liquids exist or may exist.
6. Check valves should be installed by the applicant, tested periodically by the utility and repaired immediately if leakage is found.
7. Where check valves or other backflow protection devices are installed, the customer must also install, at his expense, a pressure relief valve as close as possible to the backflow device.
8. The customer must inspect check valves or other protective devices for watertightness at least every three months (required by California law).
9. Water service may be discontinued immediately if protective devices are found to be defective or if unprotected cross connections are found to exist on the premises.

Ground Wire Attachments

No actual damage to utility property is known to have occurred from connecting ground wires to water facilities. Most such wires carry alternating current, which does not cause electrolysis. City ordinances frequently require that certain equipment be so grounded for safety. In order to cover the possibility of damage from the use of water facilities for a foreign purpose, however, the regulations should prohibit the connections and make the customer responsible for damage caused by them if installed surreptitiously.

Water-Receiving Equipment

The poor condition of water-receiving equipment is the cause of most complaints of excessive bills, and frequently of low pressure as well. The customer should be advised to watch for leaks in plumbing, and it is well to inform him how much slow leaks can increase the water bill.

Of special importance is the warning that he is responsible for valves being turned off when the service is originally turned on. The utility employee should not leave a service on if the meter shows water flowing, but the customer should be made responsible for damage if it occurs from this cause.

Water-receiving equipment, such as reciprocating pumps, which can cause bad vibration in the mains should be prohibited.

No building should be demolished without first notifying the utility to shut off service.

Limitation of Liability—*John C. Luthin*

Notices

A provision which specifies the form and content of notices by and between the utility and its customers is included in the rules and regulations promulgated by the California Public Utilities Commission and is presumably designed to protect the utility, the customer and the commission. It would appear to be unreasonable, however, for a utility to ignore a customer request because it did not comply with utility regulations on the form and methods of sending notices. Common courtesy and established legal principles should dictate the action to be taken. There may be some reason for the commission to require such a regulation, but it does not appear to be an essential part of the regulations of a municipal utility or district.

Shortage of Water

Every utility must be protected by vested powers to control the apportionment of water to its customers during an emergency period of water shortage. The difficulty of such a regulation lies in its enforcement. There are two means by which this aim can be accomplished. The first is for the utility to have the right to discontinue the service for failure to comply with the regulations, and the second is to have the method by which water is to be apportioned established by local ordinance, with violations punishable by fine or other penalty.

If the control is by discontinuance of service, numerous questions immediately arise regarding the length of time the violator can get along without water for sanitary purposes, the length of time it should take to persuade the customer to follow instructions, and whether the customer or the utility is to decide when the customer has been sufficiently warned that he must do as instructed.

A regulation giving the water supplier the right to control the use of water during a shortage is probably essential for privately owned utilities, but, if the utility is publicly owned, the situation can be better controlled by an ordinance designed for the particular occasion and enforced through police powers.

Interruptions in Service

The utility cannot be held responsible for maintaining service without in-

terruptions or for maintaining constant or uniform pressure. Temporary interruptions in service for repairs or from causes beyond the utility's control are inevitable. The customer should be apprised of the utility's limited liability and should not depend on continuous service or pressure for the operation of equipment on his premises, such as the use of service pressure to force water into steam boilers.

A regulation should be adopted exonerating the utility from liability for any damage resulting from an interruption in service due to causes beyond the utility's control or for maintenance and repairs. It should specify that, where possible and when time permits, customers will be notified of interruptions or changes in service.

Use During Fires

The need for a regulation restricting the use of water during fires is an admission on the part of the utility that its facilities are not adequate to provide the service it is being paid to render. Even though such a regulation may be justified as a means of improving fire protection, it is difficult to enforce. Whether such a rule is in effect or not, persuasion is the only means by which the use of water can be controlled. It appears, therefore, that such a regulation would be unwieldy and superfluous.

Waste of Water

The desirability of having a regulation to prevent the waste of water depends entirely upon the local supply. In California, which is limited in its future development by the availability of water, it is of the utmost importance that the people be conscious of the need for conserving their most essential resource. If, however, the utility obtains its water from an abundant local supply, with the surplus discharging into the ocean, there is no immediate need to stop wastage unless the customers are on a flat rate.

When there is an actual or threatened permanent deficit in the water supply and the use must be restricted to beneficial purposes, it is wise to have a regulation controlling water waste in general.

Column Life of Deep Well Pumps

By A. O. Fabrin

A paper presented on Oct. 11, 1949, at the Southwest Section Meeting, Oklahoma City, Okla., by A. O. Fabrin, Chief Engr., Layne & Bowler, Inc., Memphis, Tenn.

THE subject of pump life presents a variety of problems. A complete pump consists of the pump element, the column and the discharge casting at the ground level. Each of these independent but related parts presents problems of deterioration, chiefly because of corrosion. This paper, however, will deal with the life expectancy of the discharge column only.

Most engineers, lacking the time and patience to solve corrosion problems, resort to approximate formulas and graphic methods. Such a procedure is all right if the methods applied do not go beyond the limits of the experience upon which the empirical formulas are based. The present paper is not concerned with formulas, but, instead, shows in graphic form the life factors of a few installed units.

The discharge column of an installed deep well centrifugal pump is a simple structure designed to serve three purposes. When suspended in a well, it is the connecting link between the pump below the water level and the discharge outlet at the ground surface. It serves as a support for the several bearings which center a driving shaft extending from the surface down to the pump. When the pump is operating, it also acts as a conduit for conveying the water to the surface. The efficiency of the whole column is dependent upon all three functions, but consideration will be given here only to the trouble-free life of the column through which there is movement of water.

Installed hydraulic equipment deteriorates when not in use. Statements have been made that the rate of deterioration is essentially the same whether the equipment is at rest or in operation, but it is rather difficult to accept this generalization as axiomatic, as large-diameter, slow-speed deep well pumps outlast small-diameter, high-speed units. When nonoperating hydraulic machinery is submerged in static water, it is fair to assume that the length of time for destruction by corrosion will be identical for two conduits of different size but with the same metal wall thickness.

Corrosion by Friction

Consider a pump column and an operating pump. To simplify the comparison, assume that a portion of the column is surrounded by static water. Although the water level in some wells will vary seasonally and there are also fluctuations peculiar to the operation cycle of the pumping unit, such variations are not accompanied by high water velocities. It may therefore be assumed that the destruction of the pump column exterior is comparable

with that indicated for nonoperating apparatus.

Within the column, water moving at considerable velocity is in scouring contact with metal surfaces. Neglecting for a moment the ideal water well and assuming that some sand is being handled, the destructive action seems obvious. Even in the ideal well with no sand, metal will still be destroyed when in contact with high-velocity water.

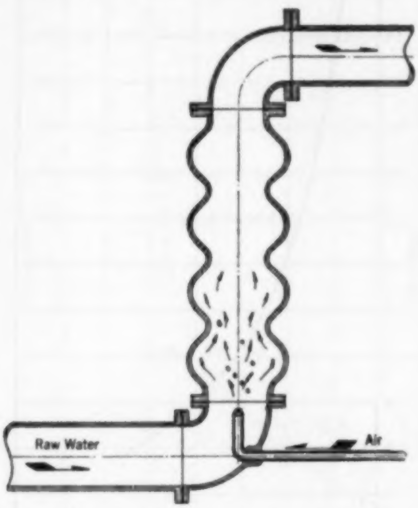

Fig. 1. Constricted Pump Column

Any two media in moving contact with each other will result in destruction—for example, hard rock is eroded by clear, running water.

This form of destruction proceeds at a slow rate, which is influenced by the amount of wetted surface and the speed of flow. Doubling the diameter of a pipe increases the volume four times if the rate of flow remains constant. It naturally follows that, for a given velocity, the wetted surface of the larger pipe will be twice that of the smaller one. Omitting surface quality and involved mathematics, direct reasoning shows that the life of the larger pipe will be double that of the smaller.

The foregoing has been confined to the wearing of metal due to surface friction. Corrosion by galvanic couples will be ignored, not because it is absent, but because the manufacture of pumping equipment requires different kinds of metal in fluid contact with each other. True, the better the metallurgy, the longer the life, but the economic factor makes the use of noble metals prohibitive. In fact, if metals for pump construction were selected in accordance with the electromotive table, the specifications would indeed be complex and difficult to fulfill in practice. The use of two dissimilar metals in countless valves and fittings indicates that, under most conditions, a reasonable life span can be expected, even though waters of all known types are involved.

Design Considerations

When rapid destruction of metal has occurred, it is safe to say that a little more attention to design would have prolonged its life. Space is often a deciding factor, however, and ideal hydraulic proportions must be sacrificed to some extent. Where conditions permit, it will be found that easy curvatures and the absence of swift or abrupt changes in flow area and of sharp protruding shoulders are conducive to long life. It is generally accepted that all water holds air in solution and that gases are easily set free in eddies. Quick changes in area not only invite eddies but also create sudden variations in the absolute pressure of the water. Thus, there is a liberation of oxygen accompanied by a scouring ac-

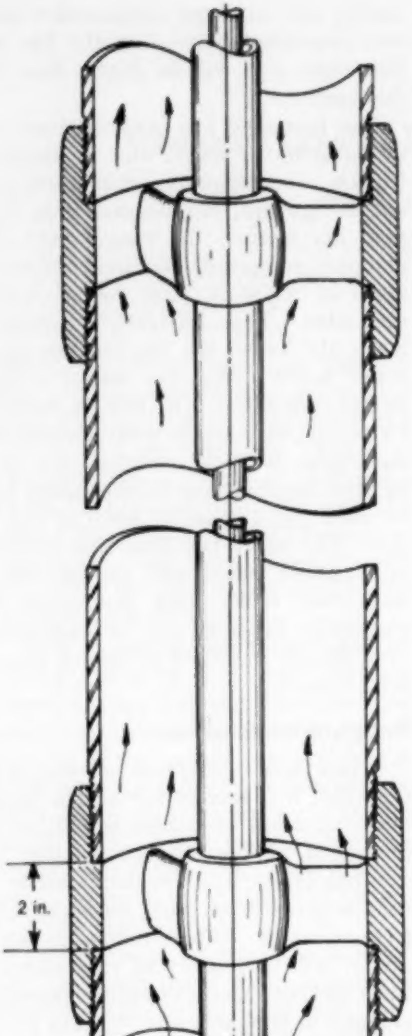

FIG. 2. Ordinary Pump Column

tion from the eddies. A patented device now manufactured in Europe utilizes rapid changes in absolute pressure to release oxygen from water being treated. As shown in Fig. 1, air is admitted into a stream of water flowing through a vertical conduit. The conduit is constricted at regular intervals so that the velocity of flow, and the accompanying absolute pressure, change throughout the length of the riser. This change in absolute pressure releases the oxygen within the stream, which oxidizes dissolved iron and washes out gases and volatile odors.

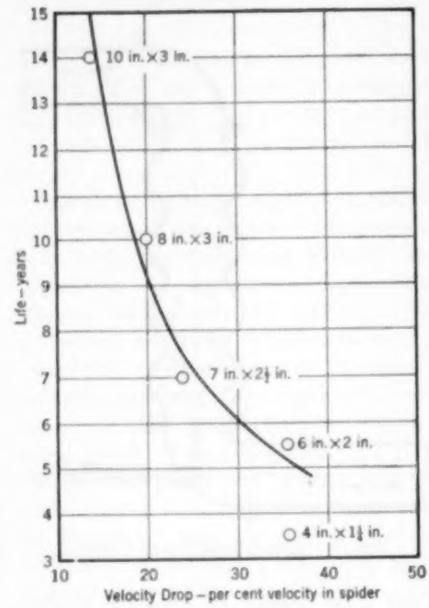

FIG. 3. Column Life and Velocity Drop

The deep well pump column shown in Fig. 2 is not contorted, but the regularly spaced bearing supports reduce the flow-through area at the support stations. Thus, the speed of the water increases when it enters the spider area and drops after passing through.

Some manufacturers do not employ spiders in the pump column. It is a fact, however, that a serious replace-

ment problem occurs in the portion of the column immediately above the pump bowl (1). The discharge nozzle area of the pump bowl is naturally restricted by straightening vanes and a substantial central hub. This restriction is often greater than that created by the column spider. Furthermore, the maximum liberation of gases—and, consequently, the greatest destruction

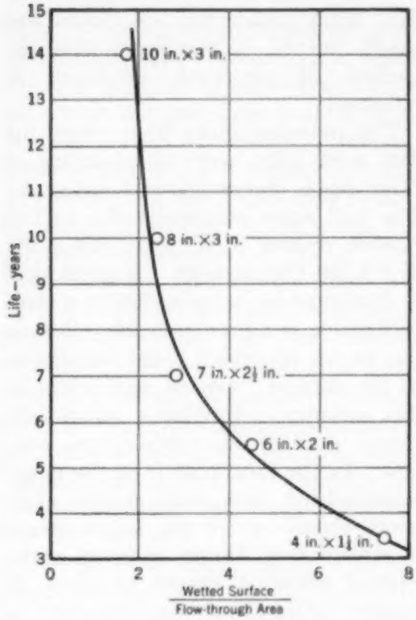

FIG. 4. Column Life and Ratio of Wetted Surface to Flow-through Area

—will occur at this station. The same conclusion may be drawn as in the study of spider construction.

It has been observed that the zone of maximum corrosion on oil tubing or shaft, if open shaft construction is used, extends from 18 to 24 in. above and below the spider. Corrosion also takes place at the main pipe junctures but does not extend as far above and below the spider as it does in the oil tube or shaft.

Velocity Factor

A limited number of observations indicates that the life of a column, with respect to corrosion, is dependent, to a large extent, upon the velocity drop through the spider. Figure 3 shows the life in years for various values of velocity drop from the spider to the

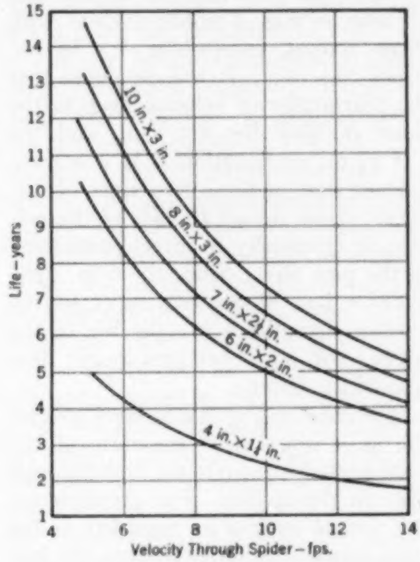

FIG. 5. Column Life and Velocity Through Spider

pipe, the drop being expressed as a percentage of the velocity in the spider. Only five data points are shown because it is extremely difficult to obtain accurate information on the subject. The data portrayed have been checked with the records, however, and there is every reason to believe they are correct.

For several reasons, the indicated observations do not lie on a smooth curve. First, the replacement of sec-

tions of column is dependent upon the judgment of the operators. Second, while geometric similarity in the design of different spiders is desirable, deviations from this ideal are necessary because of the different combinations of pipe and oil tube sizes. It is remarkable that, after taking these facts into consideration, the scatter in observations is not greater than that shown on the chart.

All of the combinations of pipe and oil tube in Fig. 3 utilize spiders with three spokes, except the 4 × 1¼ in., which has two. It will be noted that the percentage of velocity drop is the same in both the 6 × 2-in. and the 4 × 1¼-in. combinations. It is a coincidence that in these two sizes of different spoke design the life of the column is essentially in direct proportion to the pipe size. Since the 6-in. combination has 50 per cent more wetted surface than the 4 in., the life of the former will be 50 per cent longer than that of the latter.

The chart in Fig. 4 considers column life as a function of the ratio of the total wetted surface to the flow-through area in the spider. For convenience, the wetted surface is regarded as the total area of the spider spokes, the hub and an annular area 2 in. wide around the pipe (*see* Fig. 2). The flow-through area is that of the pipe minus the area taken up by the hub and spokes of the spider. Once again, it will be noted that a fairly rational curve can be constructed on the basis of the observations.

Still another approach to this interesting problem is illustrated by Fig. 5, in which column life is dependent solely on the velocity through the spider. It was assumed when constructing this chart that column life varies inversely with the rate of flow through the spider.

Conclusion

In presenting this paper, the author is fully conscious of the fragmentary data upon which the life charts are based, but he is convinced that the method of approach employed is rational.

The pumping units from which the data were taken were all operating in Mississippi, Tennessee and Arkansas. The well water involved had a carbon dioxide content of 65 ppm. and a pH of 6.5, on the average. A great deal of data must be compiled before a comprehensive pump column life schedule can be set up which could be applied to the various types of well water in this country. Emphasis should be placed on the dissolved-oxygen content. In the meantime both the pump manufacturer and water works engineers should strive for improvement in stream flow design of pump parts. Special attention should be given to smaller units, since the majority of deep well pumps used in water supply have capacities in the neighborhood of 500 gpm.

Reference

1. Alexander, L. J. Purchase and Maintenance of Deep Well Pumps. Jour. A.W.W.A., **38**:1197 (Oct. 1946).

Long Beach Experience in Accounting for Water

By C. Kenyon Wells

A paper presented on Oct. 27, 1949, at the California Section Meeting, Sacramento, Calif., by C. Kenyon Wells, Asst. Gen. Mgr., Water Dept., Long Beach, Calif.

TO be managed and operated intelligently and efficiently, a water utility must be provided with means for accurately measuring the water it handles. A precise knowledge of the exact amounts of water received by and delivered from the distribution system is required in order to cut costs and prevent water waste.

In Southern California, where the end of available additional water supplies is already in sight, the wastage of water will be considered in a far more serious light in the years to come. Only through the intelligent conservation and utilization of precious water supplies can a future decline in the state's industrial and economic progress be prevented.

The purpose of this paper is to explain in some detail the methods and equipment employed by the Long Beach, Calif., Water Dept. in accounting for water.

Typical of many American cities, Long Beach rose to industrial importance during World War II, but, unlike many war-developed cities, it failed to slip back into obscurity with the passing of wartime activities. Instead, it has continued to grow and expand throughout the postwar period. Its strategic location on the Pacific coast, its unequaled harbor facilities and varied industry, together with its vast oil production, have made Long Beach internationally known as a port city of great economic promise.

Having passed through the village stage before the beginning of the century and attained a population of slightly over 164,000 in 1940, the city expanded rapidly during and after the war to a present population of approximately 280,000, which places it fifth in size in California. Such an expansion could not have taken place without severely overtaxing the facilities of the municipal water department.

The urgent need for water system expansion was met in the spring of 1948, when the electorate passed, by a 10 : 1 majority, a $6,400,000 bond issue for financing the water department's master expansion plan. This plan calls for the construction of a new 40-mil.gal. reservoir; the addition of 20 mil.gal. of storage to the existing 40-mil.gal. reservoir; the construction of approximately 24 miles of transmission and distribution mains, ranging in size from 20 to 54 in.; and the construction of a booster pumping plant. Another two years will be required to complete all projects under the master plan. In addition, a much needed 25-mgd. plant to treat the local well water is under construction, financed from current revenue. To date contracts totaling nearly $4,000,000 have been let, and the projects are now in various stages of completion.

In all of this water system expansion, facilities for accurately measuring and accounting for water have been kept constantly in mind.

Long Beach has two water supplies: local well water pumped from 27 wells, and Colorado River water made available to the city through the facilities of the Metropolitan Water Dist. of Southern California. Both of these supplies are accurately metered as they are received into the system.

Well Supply Metering

The well water supply is measured by impeller type meters of saddle construction, installed on the discharge lines from the wells. The location of these meters is important for accuracy of measurement, and care must be exercised to position them in such a way as to provide at least eight to ten diameters of straight, streamlined flow ahead of the meter. These meters are read at the same time each day, as nearly as possible, and a continual close scrutiny of the pumping records will usually give the first indication of meter trouble.

The accuracy of each meter is tested at regular intervals with a Hall flow meter. This instrument, which is an adaptation of the pitot tube, has been checked on many occasions with other types of measuring devices, such as the inclined mercury manometer and pitot tube, and has almost always shown surprising accuracy.

The same care that is exercised in positioning the meter for straight, streamlined flow must be used in locating the point at which to insert the flow meter tube in the well discharge line, if accurate measurements are to be obtained. At this point a 1-in. corporation stop is installed in the exact top center of the discharge line. An adapter on the flow meter provides a means for screwing it onto the corporation stop while the latter is in a closed position. The stop is then opened and the flow meter tube inserted down the stop into correct position in the pipe, without having interrupted the discharge from the well.

When the test reveals a large discrepancy between the flow meter and the regular meter, the latter is removed for repairs, but, if the difference is within 2 or 3 per cent, a correction factor is applied to all readings of that particular meter.

Incidentally, at the same time that the meter is tested for accuracy, readings are also taken of the water level in the well and of discharge pressures and electrical energy input to the pump, thus providing the factors for accurately computing the pump efficiency.

River Supply Metering

The Colorado River water supply is measured by the city as it enters the system at several points of takeoff from the 36-in. lateral of the Metropolitan Water Dist. At present the department has one 12- and two 20-in. connections, each equipped with impeller type compound meters, giving reasonable accuracy on both large and small flows. Recently, however, the impellers used to measure small flows in the 20-in. compound meters were removed, being considered unnecessary because the flow through the meters is now continuously above the range of the small impellers. This condition in reality makes the compound meters simple single-impeller main-line meters. In addition to the three metered takeoffs mentioned, there are two 12-in. emergency connections from the Metropolitan Water Dist. system, both equipped

with main-line single-impeller type meters. Their accuracy range is adequate for the limited emergency use to which they are subjected. These impeller type meters, measuring Colorado River water into the system, are also checked for accuracy with the Hall flow meter from time to time.

During the past two or three years most of the water purchased from the district has passed through the two 20-in. metered connections. Maintenance costs on these two meters have been high for two reasons: first, the water demand has reached a rate of flow well above the manufacturer's recommended range for the meters, requiring the impellers to operate at excessive speeds; and second, the softened Colorado River water, being relatively corrosive, is aggressive to the meter parts, making frequent cleaning and repairs necessary.

The meters were originally provided with metal impellers, but these were later replaced with plastic ones which have given more satisfactory service. In all installations except the emergency connections, the meters are equipped with combination indicator-recorder-totalizer instruments to facilitate reading and provide a permanent record of flow.

As a result of the experience of the department with the operation of these relatively large impeller type meters, in the future only the smaller sizes, 16 in. and under, will be used. Where main-line meters, 20 in. and larger, are required, the venturi type will be employed.

This policy has been adopted for several reasons. It is seldom possible to close down large main lines conveniently to remove the working parts of an impeller type meter for periodic repairs. Even though it is possible to replace the meter with a blind plate while the repairing is being done, there is still the necessity of interrupting the flow in the line when making the change. Moreover, after the repairs have been made and the meter is again installed, an accuracy test should be run with a pitot tube and manometer to check its calibration. Furthermore, an impeller type meter, with its moving parts and bearings, is particularly susceptible to the corrosive effects of aggressive water and, when subjected to higher than normal velocities, will wear out quickly.

On the other hand, the venturi meter has several advantages when employed on large main lines. When used on Long Beach water, such a meter, if properly protected on the inside from corrosion and tuberculation with coal-tar enamel or cement lining, does not change its dimensions, and therefore the venturi tube cannot lose its accuracy. Although the instrument may need checking and repairing from time to time, it is, of course, possible to accomplish this without closing down the main line.

The type of venturi tube and instrument to be adopted must be carefully selected for each particular location. If there is an abundance of hydraulic head available, the shorter venturi tube, with its correspondingly higher head loss but lower price, may be economically employed. If head must be created by pumping, however, an analysis may reveal that it would be cheaper in the end to install a long type of Herschel tube which, although more costly, has an exceedingly low head loss.

When the Metropolitan Water Dist. constructed the 36-in. lateral to supply

water to Long Beach, a venturi meter was installed in the line to measure for the district all deliveries to the city. Unfortunately, however, demands for water developed within the city upstream from the meter, and, consequently, the 12-in. and one of the 20-in. connections previously mentioned had to be installed ahead of the venturi. The district must now add the reading of its venturi meter and the readings of the two water department meters upstream to obtain the total delivery to the city. This condition is expected to be corrected in the future by moving the venturi meter upstream to a position ahead of all possible takeoffs to Long Beach.

The new 40-mil.gal. reservoir being built as part of the master expansion plan will be supplied with water through a 42-in. connection to the new 54-in. Victoria Street lateral of the Metropolitan Water Dist., now under construction. The flow through this service connection will be measured by a 42-in. venturi meter, equipped with a 20-in. throat and provided with a combination indicator-recorder-totalizer instrument located in the operator's building. This meter, although owned by the Long Beach Water Dept., will be used by the district to measure the amount of water delivered to the city. Under a mutual agreement, the district will have free access to the meter at all times for reading and accuracy testing.

For record purposes, each meter on water entering the city's system is read daily between 2 and 6 A.M. By adding these daily readings at the end of each month the total water received into the system is obtained. This figure represents the amount which must be accounted for as closely as possible.

Consumer Use

Consumer use of water has been broken down into two categories—paying and nonpaying. Paying consumer use is the amount of water distributed to customers, who must pay for all water used. Nonpaying consumer use is the amount used by the city for buildings, grounds, pumping plants and corporation yards, for which the water department receives no revenue. Included in this category is the water used on approximately 1,000 acres of parks and golf links. Both paying and nonpaying consumer use is completely metered.

Paying consumer use accounts for the largest block of water distributed. If a water utility expects to remain on a sound basis, it must keep this block as large as possible, relative to the total amount of water delivered into the system, for it is the sale of this water, and this water alone, that brings revenue to the utility. Long Beach has approximately 54,000 customers, whose services range in size from $\frac{3}{4}$ to 16 in. and whose water consumption must be accurately metered.

For $\frac{3}{4}$-, 1-, $1\frac{1}{2}$- and 2-in. services, the positive-displacement disc meter is employed to measure flow to the consumer. For 3-in. services, two 2-in. disc meters in parallel are used, while for 4- and 6-in. services, the bronze-cased compound meter is used. In the latter, the large flows are measured by an impeller meter and the small flows by a positive-displacement disc meter, a combination which has proved very satisfactory over the years. For services larger than 6-in., batteries of 6-in. bronze-cased compound meters are standard practice. For instance, an 8-in. service would call for two 6-in.

meters in parallel, and a 10-in. service would require three 6-in. meters. This arrangement provides an advantage in large services since it is possible to remove one meter at a time for repairs and checking, without shutting down the service.

Meters up to and including 2 in. in size are installed in precast concrete boxes, while the larger ones are set in poured concrete vaults, provided with checkered steel cover plates in which are inserted removable reading lids. These larger meters are installed with Dresser couplings to give the necessary flexibility for removal.

Long Beach also furnishes a temporary metered service for contractors when water is required for a comparatively short period of time for construction purposes. For this use, a 2-in. disc meter is installed beside the nearest available fire hydrant and is connected to the top flange of the hydrant so as to not interfere with its use in fires.

Fire Lines

A private fire line is a service from which it is unlawful to draw water except to fight fires. A 2-in. fire line, which is the smallest size permissible in Long Beach for the protection of a building, is equipped with a 2-in. disc meter. For larger fire lines, a detector check is provided to show the use of water. On small flows, the bypass meter on the detector check will accurately measure the amount used, but for heavy fire flows the bypass meter merely indicates that water was used. The meter readers regularly read the fire line meters, and, if consumption is indicated, a check is made to determine if there has actually been a fire. If the investigation reveals that there has not, the owner of the property is warned that unlawful use has been made of the fire line. In addition, he is ordinarily billed for the water consumption registered by the disc meter (on a 2-in. line) or indicated by the bypass meter (if a detector check is involved). In the latter event, it is, of course, recognized that the bypass meter may have registered only a fraction of the actual water used. It is difficult to prove, however, that more water passed through the detector check than was indicated on the bypass meter.

Sometimes, when it is suspected that unlawful use is being regularly made of a fire line, a recording instrument is installed on the bypass meter of the detector check and a record is made over a period of several days. The recording charts indicate the time of day that water is being stolen and the rate at which it is passing through the bypass meter. The offending customer confronted with this evidence seldom wishes to carry the controversy further. Instead, he is usually willing to pay his bill and cooperate.

When the department is properly notified, it is permissible to use a nominal amount of water for regular tests of fire sprinkler system equipment.

Mention should also be made of a combination of domestic or industrial service and a fire line. For this type of service, a fire flow meter is installed, which uses a bypass meter to measure the small flows accurately and a proportional meter for the large flows. A small percentage of the main flow goes through the proportional meter, which has been calibrated to register the total flow directly. Unlike the compound type, which passes the main flow through an impeller type meter,

and for various other reasons has a relatively high head loss on heavy flows, the fire flow meter opens up and presents a practically unobstructed, full-size orifice for large flows, giving an exceedingly low head loss while at the same time measuring the flow through the proportional meter.

This type of service is valuable for schools, hospitals and industries where a single adequate piping system supplies water for all purposes, including domestic, industrial and fire uses. Such a system can supply water to fire hydrants spaced throughout the yard and also to hose racks located in the buildings. Under these circumstances, since all the water is metered, it is perfectly permissible for the customer to make use of his fire hydrants for purposes other than fire fighting.

Meter Reading

In Long Beach, the customers' meters are read each month. The city is divided into districts and all meter readers generally work in the same district until it has been completed before moving on to the next, covering the entire city each month. The meter-reading areas are shuffled monthly, so that no reader covers the same area twice in succession. In this way, each customer's meter is read on approximately the same day every month, and meters are being read and bills are being prepared and mailed each working day of the month.

The billing for any calendar month represents a month's business or the total monthly consumption of all paying consumers, but the consumption corresponding to these bills is composed of portions of two months' consumption. For example, meters read on November 1 represent October consumption; meters read in the middle of November represent consumption for the last half of October and the first half of November; while meters read on November 30 represent consumption for November. The actual consumption in November is usually less than in October, but, as the bills for November reflect portions of consumption in both months, they may indicate a consumption in excess of the amount of water received by the system in November. This situation results from the fact that the amount received by the system is calculated strictly on a

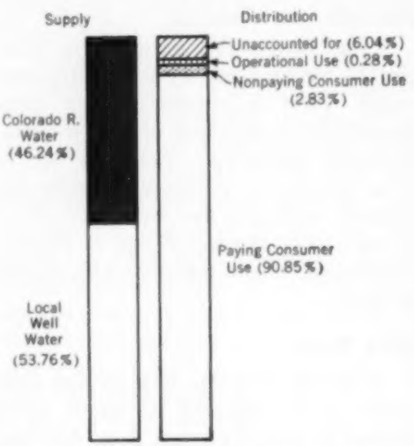

Fig. 1. Long Beach Water Use, 1948–49

calendar month basis. Consequently, water consumed and water received by the system must be compared on an annual basis to obtain figures that can be used intelligently. The differences from month to month between water delivered to the system and water consumed average out when considered over the year, giving an accurate accounting of the water.

Operational Use

In addition to paying and nonpaying consumer use, there is a third classi-

fication, called operational use, covering water used for certain purposes by various city departments. Water department consumption in this category includes:

1. All water used for flushing mains to correct complaints of bad water—computed by the use of a pitot tube at the discharge of the flushing hose.

2. All water lost in main breaks—which can be estimated from pressure drops on the nearest recording pressure gages and consumption increases registered on reservoir discharge meters.

3. All water lost from the operation of draining and cleaning reservoirs—computed from information at hand.

4. All water used for settlement of trenches—measured by portable construction meters.

5. All water used in chlorinating mains—measured by the rotameter on the portable chlorinating machine or by the use of a pitot tube at the flushing discharge.

Operational use by other city departments includes:

1. All water used by the public service department in flushing sewer mains, watering trees and sprinkling streets—measured by portable meters or based on the number and size of tank trucks.

2. All water used by the fire department—based on its estimates.

Accounting for Water

All of the elements used in accounting for water have now been described. The accompanying graph (Fig. 1) shows the values for these various items in the fiscal year 1948–49, which may be regarded as typical for Long Beach. In this year the water supplied to the system consisted of 53.76 per cent local well water and 46.24 per cent Colorado River water. The water distribution figures were: 90.85 per cent, charged to paying consumer use; 2.83 per cent, to nonpaying consumer use; and 0.28 per cent, to operational use; leaving an unaccounted-for balance of 6.04 per cent. During the past twenty years the annual unaccounted-for balance in Long Beach has averaged slightly more than 5.0 per cent, ranging from a low of 3.16 to a high of 7.27.

It is surprising to most water works men how insignificant the operational use of water actually is. As a matter of interest, Table 1 has been included to indicate the comparative magnitudes of the various items in this block. No doubt many water works operators would feel that the work entailed in computing and assembling these figures on operational use is not justified.

TABLE 1

Operational Water Use, 1948–49

Department	Per cent of Operational Use	Per Cent of Total Water Supply
Fire	14.41	0.04
Public Service	24.49	0.07
Water		
Chlorinating mains	1.73	0.005
Settling trenches	1.92	0.005
Cleaning reservoirs	5.16	0.01
Main breaks	17.87	0.05
Flushing mains	34.42	0.10
Total	100.00	0.28

Unaccounted-for Balance

It is now appropriate to scrutinize the unaccounted-for balance and to attempt to determine what it consists of. Certainly it includes the amount of water lost in small leaks and breaks, which is impossible to estimate or account for. It is logical to assume, however, that the total of these losses will be no greater than the total estimated

and accounted-for losses from larger main breaks, and the latter figure amounts to only a small percentage of the operational use, which is itself an insignificant item. Furthermore, soil conditions in Long Beach are such that leaks are immediately apparent at the surface and are soon repaired. A water waste survey made in 1946 by a consulting engineering firm verified the belief that there are no sizable leaks in the system.

All stolen water is, of course, included in the unaccounted-for balance. Water is stolen in curious and devious ways, including direct connections to fire hydrants, bypasses around meters, direct connections to discontinued services and unauthorized use of fire lines. The latter, however, is soon detected. With a vigilant water department and an alert group of meter readers and employees, the amount of stolen water will undoubtedly be held to an insignificant figure.

Some water departments may be confronted with excessive evaporation losses due to large exposed water storage surfaces, but not Long Beach. All water is stored in covered reservoirs, totaling approximately 224,000 sq.ft. in surface area. A computation by Myer's formula indicates approximately 22 in. of evaporation loss, or slightly over 3 mil.gal. per year. This amount is only 0.03 per cent of the water supply for the year 1948–49.

It is apparent, then, that none of these unaccounted-for losses are significant in size, and probably their total would not exceed 1–2 per cent, leaving 4–5 per cent of the supply still unaccounted for in 1948–49. Assuming that the meters measuring incoming water are within the generally accepted standard of 2 per cent error, it can be concluded, theoretically at least, that the consumers' meters actually have an average accuracy of perhaps 96 per cent.

This conclusion is essentially verified by meter shop experience and records. The approximately 4 per cent of consumers' use which is not being registered on the meters represents approximately $85,000 in uncollected revenue for the year.

If regular and more frequent testing and maintenance of meters can save a substantial portion of this lost revenue, it constitutes a challenge to the department to make every effort to keep its meters as close to the 100 per cent average accuracy point as possible.

The author is well aware that these latter considerations may be regarded by some water works men as highly theoretical. They may say that 6 or 7 per cent unaccounted-for water is as close to perfection as present-day metering equipment will permit. Nevertheless, the Long Beach Water Dept. expects to continue its effort to maintain unaccounted-for water at an absolute minimum, for it is only in this way that management can be assured of a maximum revenue return for each cubic foot of water delivered into the system.

California Practice in Accounting for Water

By Oswald A. Gierlich

A paper presented on Oct. 27, 1949, at the California Section Meeting, Sacramento, Calif., by Oswald A. Gierlich, Water Supt. & City Engr., Manhattan Beach, Calif.

A SURVEY of selected, typical water plants, supplying populations which range from the minimum to the maximum served by California utilities, has been made to obtain data on practices in accounting for water. It was felt that this limited survey would yield results as satisfactory as a more comprehensive one.

A simplified questionnaire was used, containing a minimum number of inquiries. These included the type of ownership (municipal, district or private), the population served, the source of supply, the methods used in determining both production and sales, and a breakdown of the various types of use measured.

Diversity of Plants

California utilities employ diversified sources of supply, including mountain watershed storage; aqueducts; tunnels; streams; wells, both artesian and nonflowing; and often a combination of several or all of these alternatives.

Among the areas served are extensive irrigation districts, supplied from open storage basins and unlined canals, and heavily industrialized localities with high pressure requirements, such as the city of Vernon, in Los Angeles County, which has practically no domestic consumption. Some utilities supply domestic, industrial and irrigation water through the same system. Others use dual distribution systems, a pressure system for domestic purposes and a gravity system for irrigation, both systems being served from one source of supply. This situation is found in the San Joaquin and Sacramento Valleys, and in the large citrus and agricultural districts throughout California. San Francisco and Avalon have both a domestic and a high-pressure salt water fire system.

A few cities have dual distribution systems comprising separate storage and distribution lines. On the other hand, Arcadia, Calif., for example, which had a population of 3,000 in 1916, when its initial installations were made, anticipated the diversified demands by laying mains from 8 to 30 in. in diameter to provide ample capacity for both irrigation heads and domestic consumption. At the other extreme, Manhattan Beach, Calif., has practically no industry or irrigation, with approximately 99 per cent domestic consumption. Naturally, this fact permits much smaller mains.

Also covered in the survey are municipal and county water districts and private companies serving one or many localities, including agricultural and industrial communities, municipalities and unincorporated areas.

TABLE 1—*Types of Water Use Accounted for by Typical California Utilities*

Municipality, District or Company	Population	Type of Ownership	Supply Sources	Production Fully Measured	Services Fully Metered	Water and Sewer System Flushing Measured	Public Places Metered	Street, Fire and Park Depts. Measured	Line Loss Determined
Group *A*—over 100,000									
Los Angeles	1,805,000	municipal	aqueduct, Colorado R., wells, etc.	yes	yes	estd.	yes	yes	yes
San Diego	362,700	municipal	Colorado R., watershed	yes	yes	estd.	yes	yes (except fire)	yes
Pasadena	106,500	municipal	wells, streams, Colorado R.	yes	yes	estd.	estd.	partly estd.	no
Group *B*—30,000–100,000									
Fresno	64,000	municipal	wells	yes	no (13%)	no	high school only	no	no
Alhambra	45,000	municipal	wells	yes	yes	estd.	yes	parks only	no
Compton	33,000	municipal*	wells, Colorado R.	yes	no (98%)	estd.	partly	fire only	no
Group *C*—10,000–30,000									
Burlingame	19,000	municipal	San Francisco supply system	yes	yes	estd.	yes	yes (except fire)	estd.
Oxnard	19,000	municipal	wells	yes	no (10%)				
Calif. Water Service Co. (45 companies)		private	wells	yes	no	yes	yes	yes (except fire)	no
Marin Municipal Water Dist. (9 cities)		municipal	dams, reservoirs	yes	yes	no	yes	no	no
So. Calif. Water Co. (35 districts)		private	wells, springs, other systems	no (95%)	no (95%)	estd.	yes	no	estd.
San Gabriel County Water Dist.	18,500	district	wells	yes	yes	estd.	yes	no	estd.
Manhattan Beach	18,500	municipal	wells	yes	yes	estd.	no	no	estd.
Santa Paula	14,000	municipal	wells	yes	yes	no	yes	yes	no
Fullerton	13,000	municipal†	wells, Colorado R.	yes	yes	no	yes	no	no
Group *D*—3,000–10,000‡									
Typical city	9,000	municipal	wells, springs	yes	yes	estd.	yes	yes	yes
Typical city	5,500	municipal	wells	yes	yes	no	50%	no	no
Typical city	3,000	municipal	wells	yes	no (98%)	no	no	no	no

* Serves 90 per cent of city. Private companies serve remainder.
† Serves 95 per cent of city. Private companies serve remainder.
‡ Utilities included are: Carpinteria, El Monte, La Canada, Laguna Beach County Water Dist., Lindsay, Palm Springs, Rialto, Tulare and Yreka.

Summary of Questionnaire

The results of the questionnaire are summarized in Table 1.* The 24 utilities covered have been divided into four groups, according to population: Group *A*, over 100,000; Group *B*, 30,000–100,000; Group *C*, 10,000–30,000; and Group *D*, 3,000–10,000.

Group A. Of the three cities serving populations of over 100,000, Los Angeles and San Diego account for all water, either by actual measurement or by estimation. Pasadena estimates the amounts used for flushing water and sewer systems and for major public facilities, but not all of the municipal department consumption, and the city does not endeavor to determine "line loss."

Group B. In the 30,000–100,000 population group, Fresno is only 13 per cent metered and therefore is not in a position to account for all water produced. The city of Alhambra does account for all water production and sales but does not keep a record of estimated water loss. The Compton municipal water works, serving 90 per cent of the city, is 98 per cent metered; the water used for flushing and public purposes is estimated, but no line loss is determined.

Group C. Seven of the nine typical cities with 10,000–30,000 population measure their production and are practically 100 per cent metered. One large company, comprising 45 water plants in many cities, is not fully metered, and another company is 10 per cent metered, the balance of the service being on a flat rate. Under these conditions, no determination of unaccounted-for water can be made.

Group D. Because of the relatively large number of small communities covered by the survey, the 3,000–10,000 group has been subdivided into selected, typical communities having a population of 3,000, 5,500 and 9,000. Cities with 9,000 or more inhabitants generally keep accurate records of production; most are 100 per cent metered, estimate or measure unmetered water and endeavor to determine line loss. The other two subgroups, averaging 3,000 and 5,500 population, generally measure all production and have practically complete metering, but they report no attempt to determine unaccounted-for water or line loss.

Of the 24 utilities, serving 112 cities and districts, 21 measure full production, 16 are 100 per cent metered and 4 are 95–98 per cent metered. In the author's opinion, these statistics indicate a trend toward 100 per cent metering in the average water plant.

A study of the tabulation shows that most of the larger water departments are making an effort to determine the effective use of unaccounted-for water, either by actual measurement or by calculations or estimates, with the result that the actual unaccounted-for percentage is far below the 15–20 per cent often held to be normal.

Reasons for Losses

The principal uses or defects resulting in unaccounted-for water are: [1] street sprinkling and construction; [2] water system, reservoir and sewer flushing; [3] municipal facilities, including parks, playgrounds, fire protection and sometimes public schools; [4] evaporation from open storage

* For the cities listed in Table 1, the A.W.W.A. "Survey of Operating Data for Water Works in 1945" (February 1948 JOURNAL) gives the following figures on percentage of production sold: Los Angeles, 92.89; Pasadena, 89.01; Alhambra, 92.52; Southern California Water Co., 92.32; and Fullerton, 91.16.

areas and open canals; [5] water main breaks; [6] underregistration; [7] illegal connections; and [8] line leaks. All but the last item undoubtedly can be determined with a fair approximation at no great expense. It appears, therefore, that the problem presenting the most concern, from the standpoint of expense, is distribution system leakage, occurring in mains, fire hydrants, joints, valves, live or dead services, and reservoirs and other storage facilities.

There are various methods of determining the unmetered water use, thus reducing the unaccounted-for water to an absolute minimum. Discussion with a number of water superintendents, as well as a study of the written comments on the questionnaire, indicates that there are valid reasons, some political, why many water companies do not attempt or are not in a position to keep a close account or measurement of unmetered water.

In a smaller municipality, it is often impossible to obtain the cooperation of the street, sewer, parks and fire departments in arriving at a dependable estimate of the amount of water they consume, which in many cities is a considerable quantity. It would probably require the employment of a person with some technical knowledge, plus additional personnel and equipment, to maintain the required records. The author knows of one street superintendent, in charge of sewers, who was furnished a portable meter and requested to keep a record, over a twelve-month period, of the water used for various street and sewer purposes. After one trial, the street superintendent stated that he did not want to be bothered and that the metering interfered too much with the department's work and required an additional truck and man.

Economics of Problem

Smaller water departments do not have the facilities, manpower or funds required to maintain an accurate accounting of all unmetered water. A utility having 1,000–5,000 meters, with an average gross revenue of $35,000–$175,000, would sustain a yearly loss of $3,500–$17,500 if 10 per cent of its water was unaccounted for. For the smaller company, it is doubtful whether the additional work and expense involved would be justified, because, even if a comprehensive leak survey of the entire system was made and maintained, followed by immediate and systematic repair to the mains and service connections, the saving of a few thousand dollars annually would not materially affect the revenue.

Many other factors beside leaks, included in the total of unaccounted-for water, must be calculated or estimated in order to learn the percentage of actual water loss. D. W. Johnson's comprehensive article on distribution system losses (1) is recommended to readers interested in this subject.

Reference

1. Johnson, D. W. Losses in Distribution Systems. Jour. A.W.W.A., **39**: 157 (Feb. 1947).

Water Waste Surveys and Unaccounted-for Water

By E. D. Case

A paper presented on Oct. 27, 1949, at the California Section Meeting, Sacramento, Calif., by E. D. Case, Pres., The Pitometer Co., New York.

No specific percentage of unaccounted-for water can be regarded as satisfactory for all water systems. It has sometimes been found impossible to improve conditions when the unaccounted-for figure was as high as 25 per cent. On the other hand, water waste surveys of plants accounting for 90 per cent of the total supplied to the distribution system have resulted in reducing the losses still further. Many factors must be considered before it can be said that the unaccounted-for figure is too high or too low. Significant conditions can often be brought to light by means of water waste surveys.

The Pitometer water waste survey is, in effect, a complete audit of the underground system. Measurements are made at the source of supply to determine the actual amount of water delivered to the distribution system. The latter is then divided into districts, and a continuous record is made of the water entering each district in a 24-hour period. From this record, the ratio of the minimum night rate to the average flow rate for the period is computed for each district. As a rule, if the minimum night rate is less than 35 per cent of the average rate of flow, the district is considered to be free from underground leakage or other sources of waste. If the percentage is between 35 and 50, conditions are average, but investigation may be needed. Percentages higher than 50 are a definite indication of underground leakage, and a further check is made by subdividing the district at night.

All meters 4 in. in diameter or larger are tested in place during the survey. On completion, a report is submitted, showing the work done and containing a table accounting for the water supplied to the distribution system. Readers interested in additional details of the Pitometer survey are referred to previously published articles on the subject (1–3).

It can be seen that the main purpose of the survey is to locate and eliminate all sources of waste. When this objective has been accomplished, it is reasonable to expect that the unaccounted-for water should be reduced to not more than 10 per cent, but many variable factors must be taken into account.

The remainder of this discussion applies only to systems which are supposed to be universally metered, as it is almost impossible to arrive at a figure for the unaccounted-for water in an unmetered system, because of the waste due to leaking plumbing fixtures which invariably exists and which cannot be estimated with any degree of accuracy.

Important Factors

The following factors are the most important ones to be considered in deciding whether or not the unaccounted-for percentage is satisfactory:

1. *The accuracy of the station or master meters measuring the water supplied to the distribution system.* The master meters may either over- or underregister and should be tested frequently for accuracy, as an error of only 5 per cent would have an important effect on the percentage of unaccounted-for water. The Pitometer is the only means of testing the master meter in the field under operating conditions. A water waste survey was completed during the past year in a certain city in Southern California where the metered sales amounted to 83 per cent of the total consumption. A test of the master meters through which water was purchased from the Metropolitan Water Dist. showed an overregistration of 2.2 per cent of the total consumption, or 13 per cent of the difference between the water purchased and the water sold.

2. *The percentage of the total metered consumption supplied to industries or other large consumers.* The percentage sold to large consumers should be considered very carefully in deciding whether the amount of water unaccounted for is satisfactory, because the greater the percentage of use through large meters, the lower the percentage of unaccounted-for water. To illustrate, suppose that a city of 100,000 population has a consumption of 10 mgd. and an unaccounted-for figure of 10 per cent, which would indicate that there was no avoidable waste in the system. Now assume that, of the 9 mgd. sold, 50 per cent (4.5 mgd.) was supplied to industries or other large consumers. If these consumers suddenly ceased operations, the total consumption would then drop to 5.5 mgd. and the sales to 4.5 mgd., leaving 1 mgd. unaccounted for as before. The percentage of unaccounted-for water, however, would then be 18, which is high enough to indicate the possibility of underground leakage and the desirability of a water waste survey.

3. *Public use.* In many so-called completely metered cities, water for public use, such as sewer flushing, street sprinkling, fires and public buildings, is not metered. Although due allowance should be made for such use in analyzing the unaccounted-for percentage, it has been the author's experience that too much weight is frequently given to this item. The first three public uses mentioned are not continuous, and, despite the large quantities consumed for short periods, the daily average throughout the year is small, so that the effect on the percentage of unaccounted-for water is comparatively unimportant. This item can, and often does, amount to 3–4 per cent and must be taken into consideration, but, at the same time, the superintendent should be careful that an overestimate does not cover up the existence of avoidable waste.

4. *Underregistration of meters.* Large meters—2 in. in diameter and over—should be tested at least once a year without fail. Meters 4 in. in diameter or larger can be tested in place with the Pitometer by tapping the service main with a 1-in. corporation cock. The 2- and 3-in. meters should be checked with test meters or removed to the meter shop. Assuming that the large meters are maintained properly, any material effect on the

percentage of unaccounted-for water from meter underregistration must be due to the domestic meters. This item can be very important, running anywhere from 3 to 10 or even 15 per cent, depending on the local meter maintenance program.

The author believes that all domestic meters should be taken out and inspected every five or six years and replaced by new or repaired units, but this practice is governed by local conditions and, to a certain extent, by the quality of the water. In communities where the water is corrosive or unusually hard, the meters should be inspected more frequently than where the water is noncorrosive. In many states, there are laws which require private water companies, and sometimes municipal departments, to remove meters during certain specified periods.

If a proper maintenance program is followed, there is no reason why underregistration of domestic meters should amount to more than 3 per cent, and even this figure can be improved upon if meters are bought on a performance rather than on a price basis. Unfortunately, many municipalities are forced to buy the lowest-priced meter by law, and, as a result, their revenues are so reduced that they cannot afford to maintain these meters, although the fact that the cheapest meter was purchased to begin with means that it will cost more to maintain it. It is the old story of high first cost and low maintenance against low first cost and high maintenance. In the author's opinion, any money spent on meter maintenance is a wise investment, as the meter is the cash register of the water department.

5. *Unavoidable leakage*. Unavoidable leakage refers to underground leaks which exist in every system and which would cost more to locate and repair than to permit to exist. Through the years many formulas have been proposed to arrive at a fair figure to cover this item. Some methods are based on the inches of joints, others on the number of connections to the main or on both. Kuichling (4) has stated:

> A discharge of one drop per second from each joint, five drops from each hydrant and stop valve and three drops from each service pipe, including tap and unit cock, represents a fair measure of the average undiscoverable leakage in a well constructed distributing system. . . . On this basis and with the assumption that on the average there are 504 pipe joints, 12 hydrants, 10 stop valves and 100 service pipes per mile of distribution pipe, the leakage will amount to 2,742 gpd. per mile, or in round figures, say, from 2,500 to 3,000 gpd. per mile.

The Pitometer Co., therefore, many years ago adopted a figure of 3,000 gpd. per mile for unavoidable leakage, and it is believed that this amount has been universally accepted by water works operators and engineers. It can be seen that its effect on the percentage of unaccounted-for water may be very important, particularly in residential communities, where the actual use per mile of main is low. For instance, a domestic community of 50,000 people, with a consumption of 3 mgd. and 100 miles of main, would have an unavoidable leakage of 300,000 gpd. If 20 per cent was unaccounted for, half of this amount would come under the heading of unavoidable leakage, which would indicate a satisfactory situation. On the other hand, in congested industrial sections, where the consumption per mile of main is very high, the unavoidable leakage may be almost negligible.

In any event, it should be given careful consideration in determining the actual amount of unaccounted-for water.

The author has tried to demonstrate that there is no yardstick for measuring unaccounted-for water which can be applied to all systems. Consequently, before a water works superintendent or engineer becomes satisfied with or alarmed at the conditions existing in his plant, he should consider very carefully the five factors outlined in this paper.

The Pitometer Co. has, on occasion, been called upon to testify before state regulatory commissions in connection with rate increase requests by private water companies who have had a water waste survey made. Showing that the underground leakage had been reduced to a minimum was of great help in securing the increase requested. In states where the sources of water supply are limited, and where any community which requires additional water must have its application approved by a state water policy commission, it is most essential that the water works superintendent or engineer be able to convince the commission that everything possible has been done to reduce waste to a minimum.

The only definite method of establishing the actual percentage of unaccounted-for water and determining whether or not it is satisfactory is to conduct a water waste survey. Even if the results prove only that no avoidable waste exists, the fact that this condition has been verified and that a system has been installed to control future waste will certainly justify the expense involved. On the other hand, regardless of what the percentage of unaccounted-for water may be, a Pitometer survey usually results in the elimination of a sufficient amount of waste to cover its cost in a short time. The superintendent who has a survey made of his plant knows what the situation is and need no longer guess or make assumptions.

References

1. Cole, E. S. Present-Day Scope of Pitometer Surveys. Jour. A.W.W.A., **37**: 181 (Feb. 1945).
2. Beckwith, H. E. Water Waste Surveys. Jour. A.W.W.A., **38**:49 (Jan. 1946).
3. ———. The Causes and Prevention of Water Losses. Jour. A.W.W.A., **41**: 222 (March 1949).
4. Kuichling, Emil. Trans. A.S.C.E., **38**: (1897).

Telemetering Applications in a Distribution System

By Joseph J. Domas and Adolph Damiano

A paper presented on Nov. 18, 1949, at the New Jersey Section Meeting, Atlantic City, N.J., by Joseph J. Domas, Engr. of Design & Constr., and Adolph Damiano, Asst. Chief Engr., Hackensack Water Co., Weehawken, N.J.

An appraisal of the design, functional value and efficiency of a water distribution system can only be based on constant observations and reliable coordinated records of such information. The problem of designing feeders or circulating mains to correct deficiencies caused by growth, concentration or shifting of demand involves the important consideration of the effect on the distribution system beyond the immediate area under examination and study.

In most water works, the distribution system represents about two-thirds of the total value of the plant. If intelligent operation of purification plants, pumping stations and reservoirs demands precision instruments, certainly, the same reasoning should apply to the distribution system. Unfortunately, too often the distribution system is regarded as an uninteresting maze of pipelines joined together in an intricate pattern difficult to unravel. Nevertheless, each system has a number of strategic points from which continuous records of values should be obtained. These data, after being correlated and analyzed, will serve as a rational and engineering basis for the solution of distribution system problems.

The Hackensack Water Co. supplies water to 53 municipalities, with a total population of about 500,000, in North Hudson and Bergen Counties, located in the northeastern portion of New Jersey close to the center of metropolitan New York. The territory covers an area, roughly rectangular in pattern, about 7½ miles wide and 18 miles long, consisting of two longitudinal valleys and separating ridges with elevations ranging from zero to 500 ft. above mean sea level.

All water, after required purification, is delivered by pumping to the distribution system. Briefly, the system includes approximately 1,100 miles of pipe, ranging from 4 to 54 in. in diameter; three large, open storage reservoirs; two covered storage reservoirs; two elevated storage tanks; and four booster pumping stations. All services are metered.

The company endeavors to furnish a high-quality water in sufficient quantity and at adequate pressures throughout the system. To accomplish this objective economically, a sound administration policy, continuity and flexibility of service, and high efficiency in construction and operation are absolute necessities.

The first telemetering device used

by the company expressly for the distribution system was installed in 1933. Since then a planned program of telemetering essential information from widely separated points to the main office at Weehawken, N.J., has been successfully carried out. As this work progressed, other features were added, including remote pump operation.

Telemetering Systems

To many water works men, the presentation of an electrical problem means an encounter with wiring diagrams and strange terms and symbols. As the components of the system become recognized, however, the layman's understanding of telemetering grows.

Briefly, telemetering consists of reproducing at a convenient location, primarily by electrical transmission, values or quantities measured at a distant point. Transmission may be more or less continuous but the measured variable must be expressed in a readily recognized form. Furthermore, one or more secondary functions, such as regulation, control, retransmitting, totalization and integration, may be included. Basically, a transmitter, a conveying channel—either wire or radio—and a receiver are required.

Most of the earlier water works telemetering systems, which can be traced back to 1885, were devised to indicate or record water levels. About 1912 telemetering became more than a curiosity, and its use has since grown rapidly, particularly in the electric utility field. The proper adaptation of telemetering adds convenience and efficiency to any plant. The prominence of centralized control, moreover, offers many possibilities of application.

Many systems are commercially available and every conceivable electrical characteristic has been tried. Depending upon the electric variable in the transmitting channel, basic systems can be classified as "current," "voltage," "frequency," "position" and "impulse." It may be noted that some systems lend themselves better than others to the measurement and reproduction of certain quantities. For the basic needs of the water works industry, current and impulse systems are by far the most widely adaptable because of simplicity in design and rugged construction of the equipment.

The current system adjusts the value of electric current in the circuit to correspond to the measured quantity. The Republic Flow Meters Co. product is probably the best known example. The flow of current is made proportional to that of the fluid being measured by causing the value of the current to follow the characteristic law of the primary flow-measuring device. The use of a mercury column in direct contact with the rheostat terminals does away with the need for any moving parts in the transmitter.

Another application of the current system of telemetering, which has proved entirely satisfactory since its installation in 1933, utilizes an electronic method of regulating the line current, so that a minimum of moving parts is necessary in the transmitter. This apparatus * transmits the water level of Reservoir No. 2 to the New Durham Pumping Station, where it is indicated and recorded.

At the same pumping station the position system of telemetering is used to control hydraulic throttling valves installed on a 24- and a 36-in. main, both supplying Reservoir No. 2. The

* A product of Esterline-Angus Co., Inc., Indianapolis, Ind.

size of the valve opening is indicated at the pumping station, in terms of percentage of full opening, by the use of Selsyn * motors.

Impulse System

In the impulse system, the variable which is transmitted is not an electrical quantity but rather a function of time. Since it is the duration rather than the magnitude of the received signal which is important, the system is independent of wire conditions. Wide variations in voltage current or line resistance have no effect on the accuracy of the readings. Of the systems offered in this category, the mechanical impulse duration group has a number of

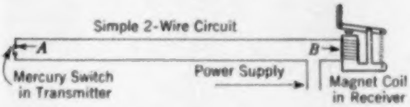

FIG. 1. Time Impulse System Diagram

commendable features, including simplicity of principle, high fidelity of transmission through circuits not necessarily perfect, nonsynchronization of transmitter and receiver, and rugged construction. For these reasons and because of satisfactory experience reported by long-time users this principle was selected to meet the requirements of the Hackensack Water Co.

Figure 1 is a simple diagram of the "Metameter" † system, which consists essentially of a two-wire electrical circuit or its equivalent, with a mercury switch, *A*, in the transmitter and a magnet coil, *B*, in the receiver. Readings of the measured quantity—pressure, liquid level, flow, temperature, motion, voltage, current, power or the like—are transmitted as a function of time in the form of successive impulses of current in the transmitting circuit. During each fifteen-second cycle switch *A* is closed for part of the period and open for the remainder, the value of the reading determining the length of time the switch remains closed.

The circuit connecting the transmitting and receiving points consists of telephone wires leased as a pair from the New Jersey Telephone Co. on a monthly rental basis of $3.00 per mile. The mileage is computed as a straight line between the connected points. In addition, an installation charge of $10.00 is made for connecting each terminal. Except for clearing the lines, no special facilities are required of the telephone company. The electromagnet in the receiving instrument operates on a current of approximately 45 ma. By the use of electric filters, both a-c. and d-c. signals can be transmitted over one pair of wires. As each Telechron * motor requires only about 6 w., alternating current, the power consumption of the system is negligible.

The Metameter transmitter (Fig. 2) consists of a constantly rotating spiral cam, driven by a Telechron motor, and, in pressure instruments, a rider actuated by the pressure element. When the rider is on the plate, a magnetic type mercury switch is opened. Conversely, when the rider is off the plate, the switch or circuit is closed. The length of time the switch is closed determines the duration of the impulse.

In the Metameter receiver (Fig. 3) is mounted a recording element operated by a Telechron motor and having

* Made by General Electric Co., Schenectady, N.Y.

† A trade name of Bristol Co., Waterbury, Conn. The use of the time impulse principle is licensed by Builders Iron Foundry, Providence, R.I.

a pen which is positioned on the chart in accordance with the deflection of the pointer in the transmitter. The electromagnet receives the impulses from the transmitter and operates on a definite time cycle established by the transmitter. The cycle is divided into two periods—energized and deenergized—the duration of each being proportional to the measured quantity.

The receiver converts the impulse into mechanical motion through the action of the electromagnet. The magnet armature actuates a braking device on an accurately timed and continuously driven arrangement of differential gearing by which the indicating pointer or recording pen is moved up or down the scale.

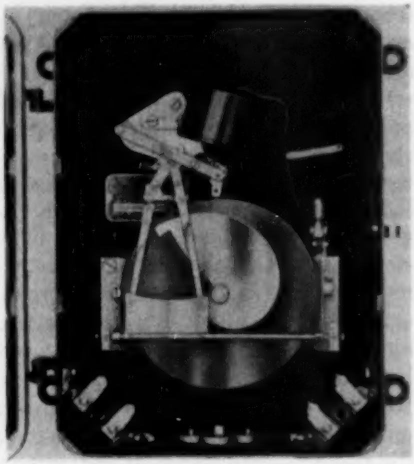

Fig. 2. "Metameter" Transmitter

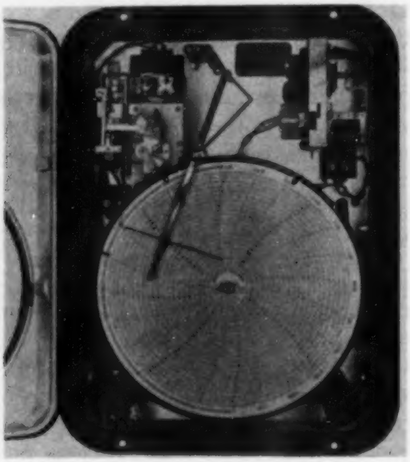

Fig. 3. "Metameter" Receiver

Carlstadt Pumping Station

The installation at the Carlstadt Pumping Station is an interesting application of telemetering for automatic control and remote as well as manual operation of pumps. The booster station serves an isolated district of high elevation by pumping from a 1.31-mil.gal. ground storage tank into a 250,000-gal. elevated tank, 100 ft. high, floating on the system. The ground tank receives water from the New Milford low-service mains through an altitude valve, and the stored water is then pumped into the elevated tank under automatic control.

Two pumps are available for operation. By means of a selector switch and two pressure controllers set at high and low limits determined by experience, one pump is started. Then, if the water level in the elevated tank should continue to drop, the second pump automatically starts. Conversely, the pumps will stop when the preset elevated water levels are reached. Under certain conditions, however, it may be desirable to start the second pump independently, which is accomplished by remote control from Weehawken. After the second pump is started remotely, its pressure controller takes

over and stops the pump automatically.

The telemetering system requires four wires (two pairs) and conveys three signals. Elevated-tank water levels and New Milford low-service main pressures are transmitted to Weehawken, each over one wire, with a third wire serving as a common return. The fourth wire is used to start the second pump from Weehawken, the circuit being completed by grounding.

One of the inherent characteristics of the Metameter which should be emphasized is that, when power is interrupted at the remote transmitter or continuity of the circuit is broken, the indicator at the receiving end moves up or down to the extremes of the scale, depending on whether the rider at the transmitter is off or on the cam. At the Carlstadt Pumping Station, separate electric services furnishing 220-v. three-phase and 120-v. single-phase power are available. Since the failure of three-phase power to the pumps would not be immediately detected, relays were installed across the phases of the power supply, their contacts being placed in series with the 120-v. supply to the pressure transmitter. The transmitter functions correctly as long as 220-v. power is available, but, if it fails, the current to the transmitter is interrupted and the Weehawken receiver indicates, in the manner noted above, that the transmitter has stopped and that investigation of the equip-

FIG. 4. Wood-Ridge Station Control Section

ment at the pumping station is necessary.

Wood-Ridge Pumping Station

The Hackensack Water Company's most elaborate installation of telemetering, automatic operation and remote control is at the Wood-Ridge Pumping Station, located in the southwest section of the company's service territory. The pumping equipment includes two 4.0-mgd. electric motor-driven units, fully equipped for manual and automatic operation, and one 4.0-mgd. gasoline motor-driven standby. Figure 4 shows the control section of the station, with the pump starting panel at the right and the telemetering and control panel at the left. A closer view of the latter is given in Fig. 5.

In the upper row are shown the two pressure controllers and the transmitter for the station discharge pressures. The lower instruments consist of the transmitter measuring the suction pressures, two pumping station recorders and a flowmeter measuring the discharge from the pumps. The delay device is at the extreme left of the panel, between the two rows.

The panel provides pressure controllers for each of the electric motor-driven pumps, as well as transmitting facilities to Weehawken for the suction and discharge pressures, including remote operation of the second pump from Weehawken. The interconnecting channel consists of four wires—one pair transmitting a straight d-c. signal for suction pressure and the other pair, a-c. and d-c. signals for discharge pressure and remote operation.

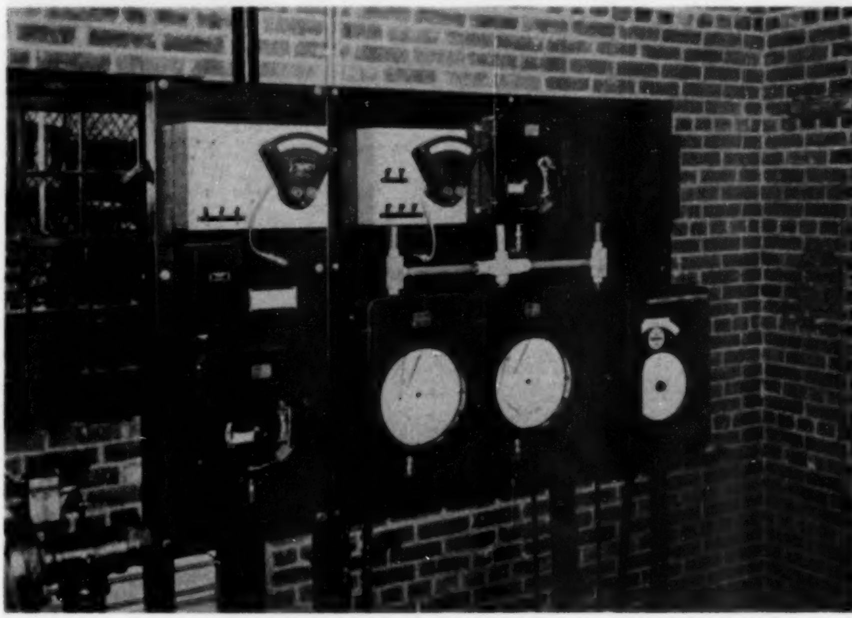

Fig. 5. Closeup of Control Panel

In addition, the discharge pressure is

also conveyed to the main plant at New Milford, indicating the pump operations at Wood Ridge by means of recorded pressure changes—an essential aid to the operating personnel. This d-c. signal is relayed from the Wood Ridge station by a repeating coil actuated by the discharge pressure transmitter.

As in the Carlstadt station, automatic control is provided by proper settings of pressure controllers. Since the pump discharge is delivered directly into the distribution system, the elimination of starting and stopping pressure surges is of extreme importance. Automatic 10-in. hydraulic cone valves on the discharges from the electric motor-driven pumps, properly timed, eliminate excessive surging. The small pressure piping to the controllers is equipped with an air chamber and snubbers to guard against surges which might result in repetitive action of the pumps through the pressure controllers, an undesirable and dangerous condition.

Two methods of automatic operation are provided: [1] starting and stopping the first pump by pressure, with the second pump remotely controlled from Weehawken; and [2] starting and stopping both pumps by pressure. The delay device keeps the second pump from being energized until a preset time has elapsed after the first pump has started. This interlock prevents the starting of both pumps together as a result of an excessive and sudden drop in pressure.

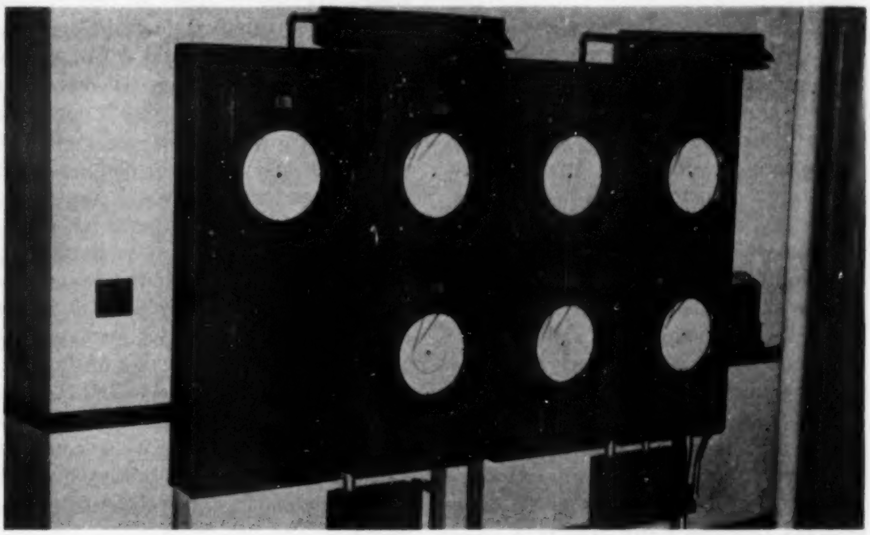

Fig. 6. Weehawken Receiving Panel

Two back-pressure control valves, 12 and 16 in., were installed at the Hackensack River crossing (30-in. pipe) in Little Ferry, to provide a relief in the system affected by the pumps at Wood Ridge and to keep "on and off" operations at a minimum. If the pressure on the west side of the Hackensack River exceeds a predetermined value, the valves open and

discharge to the east side. The pressure on the upstream side of the regulators is transmitted to Weehawken by a simple d-c. system. In this manner, continuous information and records of the action of the regulating valves are available. The transmitter is underground in a concrete vault. Moisture is excluded by means of a waterproof case, and all electric service devices are mounted within a waterproof cabinet.

Weehawken Office Panel

Figure 6 shows the panel board at Weehawken which contains all the receiving instruments. The receivers are flush-mounted in steel cabinets holding all the miscellaneous wiring, switches, fuses and power packs required for operation. Electric bull's-eyes are set into the doors of the receivers and flash on when preset pressure or water level limits are reached. Switches for remote control of motors are mounted inside the receivers out of sight. Since the panel board is located in the lobby of the main office, steel cabinets with locked fronts are used to prevent tampering and provide a neat appearance. Moreover, they can be easily extended if the addition of future telemetering systems requires more receivers.

The data obtained at Weehawken from the various transmitters previously described enable the operation of the distribution system to be readily and intelligently controlled. The installed cost of the equipment can be reasonably justified by the results. The telemetering system employed produces charts that check well with observed conditions. The little maintenance required consists principally of cleaning, lubrication and minor adjustments from time to time. The company is satisfied that the installations are dependable and is firmly convinced that telemetering will become a necessity for the successful operation of water works. It is believed that increasing use will be made of telemetering in the Hackensack Water Co. system as well as in others.

The water works man contemplating telemetering or automatic control should become thoroughly familiar with the type of system he proposes to adopt. The detailed design of the various components can be left to the manufacturer's engineers, but the prospective user should have a complete knowledge of the possibilities and advantages which the chosen system offers.

Water Quality in the Middle Atlantic States

By S. K. Love

A paper presented on Nov. 3, 1949, at the Chesapeake Section Meeting, Washington, D.C., by S. K. Love, Chief, Quality of Water Branch, U.S. Geological Survey, Washington, D.C.

NATURE has provided the Middle Atlantic States with large supplies of water of good quality. It is soft and contains relatively small amounts of dissolved minerals. In general, these natural supplies are adequate for present and future uses, but there are certain problem areas where the works of man have overdrawn on nature and have even done her a disservice by dumping wastes and refuse into the otherwise excellent sources of good water.

In this paper, New Jersey, Delaware, Maryland (including the District of Columbia) and Virginia are taken to comprise the Middle Atlantic States. These states are characterized by essentially flat plains near the coast and, except for Delaware, by broken uplands and mountainous topography toward the west and northwest.

The importance of the chemical quality of water supplies for practically all uses has long been recognized. The concentration of industry in many areas in the Middle Atlantic States has resulted largely from the availability of adequate supplies of water of suitable quality. The development of large municipal supplies has also been favored by a provident nature, although frequently at considerable cost in money and effort.

Most of the larger cities in this region obtain their water supplies from surface sources. The number of places served by ground waters, regardless of size, however, is far in excess of those served by surface supplies. The chief reason for this division between surface and ground water sources is the limited yield of the latter in relatively small areas where the population density is high. Other factors include accessibility, relative cost and chemical quality. A study made by the U.S. Public Health Service shows that the population served by public supply systems in the Middle Atlantic States in 1945 was divided between surface and ground water sources as shown in Table 1.

TABLE 1

Population Served by Public Supplies, 1945

State	Population Served	
	Surface Water	Ground Water
New Jersey	2,100,000	1,000,000
Delaware	129,000	62,000
Maryland	1,200,000	111,000
District of Columbia	892,000	
Virginia	950,000	180,000
Total	5,271,000	1,353,000

Surface Water Supplies

Surface waters in the Middle Atlantic States are in general softer and

contain fewer dissolved minerals than ground waters. Chemical analyses of the more important surface streams are shown in diagram form in Fig. 1–3 and, for some of these streams, are given in numerical values in Table 2.

New Jersey

Streams flowing through the upland section of New Jersey are harder than those rising in the flat coastal plains of the southern part of the state. Except for salt water intrusion in tidal areas, southern New Jersey has some of the softest surface waters in the four-state region. Practically all the surface waters of New Jersey are either fully developed or included in plans for complete development for municipal, industrial or agricultural utilization.

Examples of long-range planning for effective use of surface waters are the Wanaque and Pequannock River developments of 25 years ago. Under the direction of the North Jersey Water Supply Commission, these watersheds were set aside for municipal supplies, and, as a result, great quantities of water of excellent quality have been supplied to a large metropolitan area. The hardness of these supplies ranges from about 30 to 50 ppm. Other cooperative ventures have taken advantage of various surface streams for municipal supply systems in central and northeastern New Jersey.

TABLE 2

Analyses of Surface Waters

Item	Quantity—*ppm.*											
	Analysis No.*											
	1	2	3	4	5	6	7	8	9	10	11	12
Silica (SiO_2)	16	14	5.1	3.8			15	6.6	13	9.8	14	9.1
Iron (Fe)	0.8	0.4	0.2	0.04	0.02		0.27	0.02	0.23	0.10	0.20	0.05
Calcium (Ca)	25	19	1.8	13	13	14	11	28	4.6	15	9.7	15
Magnesium (Mg)	9.3	3.1	0.4	4.2	4.9	3.4	1.6	5.4	1.8	3.5	4.2	5.8
Sodium (Na)	39	2.8	3.0	3.5	6.9	6.5		5.8	3.0	6.4	6.3	2.7
Potassium (K)				1.3					1.0		1.4	1.0
Bicarbonate (HCO_3)	72	28	3.7	33	42	43	28	73	22	50	46	66
Sulfate (SO_4)	60	28	4.7	22	18	5.9	9.1	39	4.4	18	13	9.2
Chloride (Cl)	44	3.5	3.1	3.8	6.5	3.7	1.4	5.9	1.7	4.3	2.5	1.8
Fluoride (F)				0.1						0.1		
Nitrate (NO_3)	0.6	2.1	1.0	3.2	6.6	3.1		1.2	0.5	0.5	0.6	0.6
Dissolved solids	255	84	27	74	86	63	92	171	44	86	77	76
Total hardness ($CaCO_3$)	101	60	6.1	50	53	49	14	92	19	52	41	60
Specific conductance—*micromhos* (at 25°C.)				122	143							
Color			27	13	5				21	18	22	7
pH				6.9	6.8			7.6				

* Key:
1. Passaic R. near Belleville, N.J., Jan. 19, 1925
2. Raritan R. at Manville, N.J., March 21, 1925
3. Great Egg R. near Folsom, N.J., July 21, 1925
4. Delaware R. at Trenton, N.J., average 1944–45
5. Brandywine Creek at Wilmington, Del., average 1947
6. Patapsco R. near Baltimore, Md., average May 1912
7. Northwest Branch Anacostia R., average 1949
8. Potomac R. at Washington, D.C., average 1948
9. Rappahannock R. near Fredericksburg, Va., average 1930
10. James R. at Richmond, Va., average 1948
11. Roanoke R. at Randolph, Va., average 1929–30
12. New R. at Glenlyn, Va., average 1930–31

Delaware

In Delaware, the surface streams are so small that few can be used for public supplies. Wilmington and Bellevue are the only places that obtain water from surface sources. Brandywine Creek, which supplies Wilmington, has

a hardness averaging approximately 50 ppm.

Maryland

Although no comprehensive study has ever been made of the chemical quality of the surface waters in Maryland, the available information indicates that practically all are very soft, averaging less than 50 ppm. hardness, except possibly in limestone areas in the mountainous parts of the state. The Potomac River, although a boundary stream for most of its length, is the most important river in Maryland. As a large proportion of the flow originates in limestone valleys in Virginia, it is considerably harder than the other streams in the state. The Potomac River is the source of supply for part of Hagerstown and for Washington, D.C. The hardness at Washington averages about 90 ppm.

Baltimore, the largest city in Maryland, obtains its water from the Gunpowder River watershed. The water has a hardness ranging from about 40 to 60 ppm. Plans are under way to supplement the present supply by taking water from the Patapsco River.

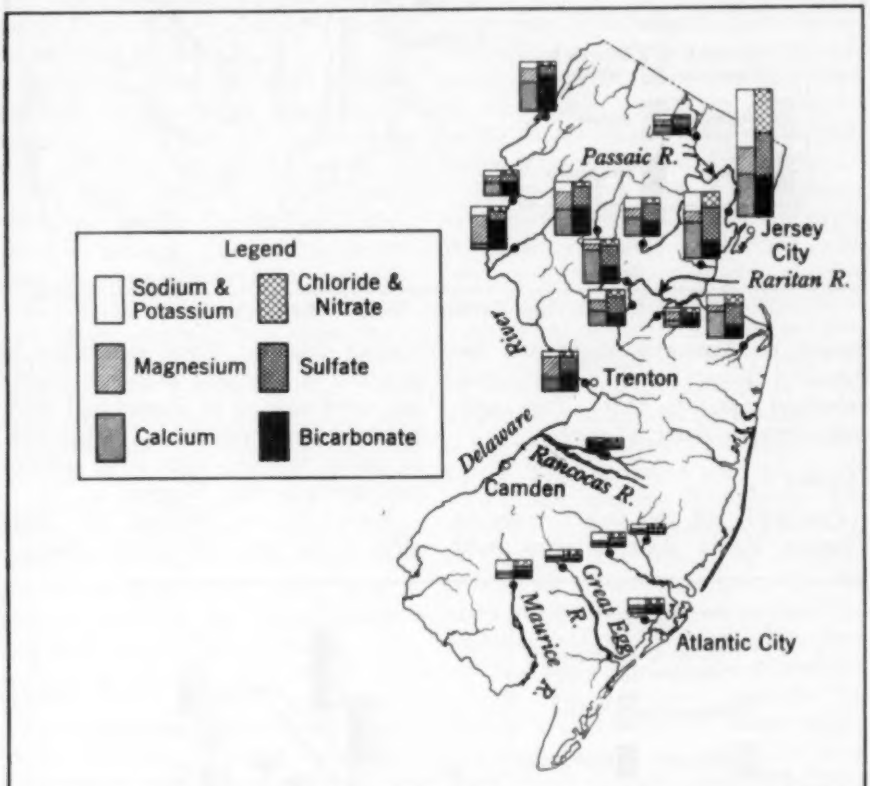

FIG. 1. New Jersey Surface Water Quality

The large and constantly growing section of Maryland adjacent to the District of Columbia is supplied with soft surface water from the Northwest

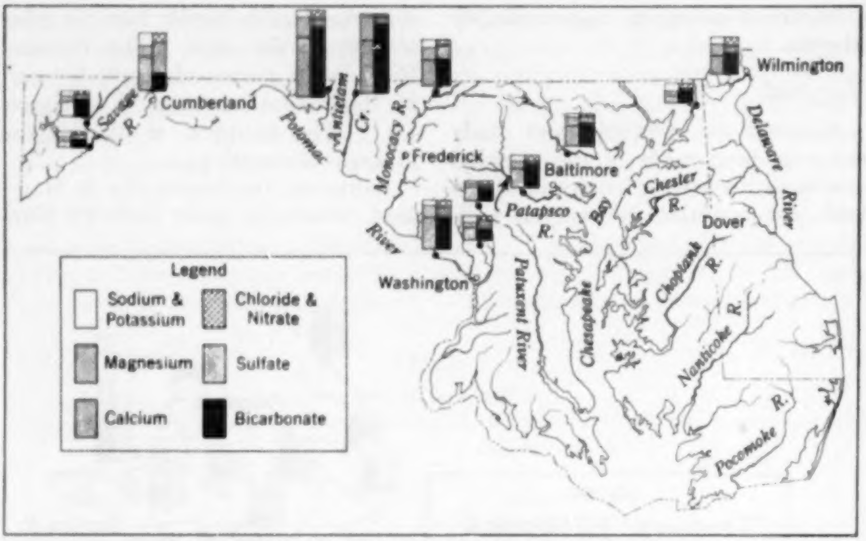

Fig. 2. Maryland-Delaware Surface Water Quality

Branch of Anacostia River and the Patuxent River by the Washington Suburban Sanitary Dist. The hardness averages about 30 ppm.

Virginia

Practically all the larger cities in Virginia obtain their supplies from surface streams. These waters are, in general, of excellent chemical quality and need only to be filtered and sterilized for municipal use. The hardness of public supplies taken from streams averages less than 50 ppm.

Rivers flowing through the limestone rocks and soils of the Shenan-

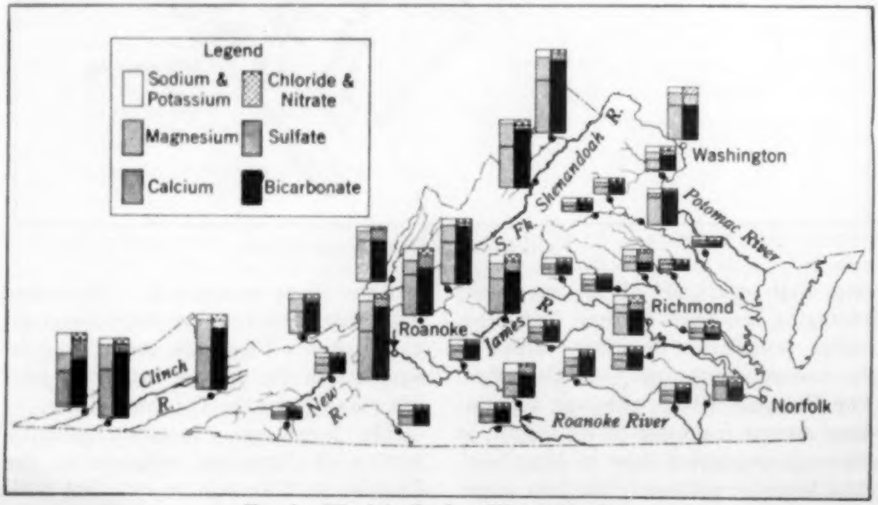

Fig. 3. Virginia Surface Water Quality

doah Valley contain moderate quantities of calcium and bicarbonate and consequently are harder than rivers rising east of the Blue Ridge Mountains. In the piedmont region, the surface streams are relatively uniform in chemical quality throughout the year and have a hardness of less than 50 ppm. The Rappahannock, North Anna, South Anna and Appomattox Rivers fall into this category.

The few and relatively short streams that flow for their entire length in the coastal plain are very soft and contain small quantities of dissolved solids.

The James and Roanoke Rivers, which rise in the Shenandoah Valley and flow through gaps in the mountains, are unusual in that they contain smaller quantities of dissolved solids in their lower reaches than near their sources. This condition is a direct result of their flowing through relatively soluble limestone areas near the headwaters and then through almost insoluble rocks and soils in the piedmont and coastal plain areas downstream. In these lower reaches, both rivers are joined by tributaries rising east of the mountains, which have a diluting effect on the higher concentrations found farther upstream.

Ground Water Supplies

As already indicated, ground waters are not furnished by public water supply systems to as large a population in the Middle Atlantic States as are surface waters, but far more water supplies use ground waters. It is customary for the majority of small cities and towns to depend on ground water because it is usually much cheaper, requires less supervision to obtain and distribute, has nearly constant chemical quality and temperature, and is generally available in sufficient quantity. Analyses of a number of ground waters in the four-state area are given in Table 3.

New Jersey

The quantity of ground water available is often unfavorable in the northern and western part of New Jersey. In the central, southern and southeastern sections, however, some of the water-bearing formations produce large quantities of soft water. Approximately 1,000,000 people, or one-third of the state's population served by public water supply systems, obtain water from underground sources.

The ground waters of New Jersey are generally soft, but in some areas they are moderately mineralized, with iron probably the most objectionable constituent present. This element is variable in occurrence both in area and in concentration, but appears to be most commonly troublesome in the Magothy and Raritan formations (1).

Ground waters obtained from wells in the Triassic shales and sandstones (2) in northeastern New Jersey frequently contain relatively large amounts of dissolved minerals. The composition of these waters suggests that the saline residues of earlier geologic inundations of the sea have not been entirely flushed out of the formations.

Salt water intrusion from the Atlantic Ocean has created water supply problems in several coastal areas of New Jersey (3), the heavy withdrawal of ground water in Atlantic City being typical. Some well supplies have been moderately contaminated with salt water, whereas others show only slight increases in chloride content. The majority of wells penetrating the 800-ft. sand are being pumped without any indication of salt water contamination. Semiannual collections of water samples from nearly 100 wells in the Atlantic City–Ocean City area are made

TABLE 3

Analyses of Ground Waters

Item	Quantity—ppm.																
	Analysis No.*																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Silica (SiO_2)	28	9.4	22	18	18	17	25	8.1	7.7	26	20	17	6.9	23	21	44	6.8
Iron (Fe)	0.07	7.9	0.31	1.1	0.26	0.13	0.04	0.12	27	0.72	0.11	0.03	5.0	3.1	0.20	0.91	5.2
Calcium (Ca)	9.0	11	37	111	502	1.5	17	1.2	15	2.9	5.1	46	27	4.8	2.3	9.1	100
Magnesium (Mg)	2.6	1.2	4.5	25	68	0.7	5.3	0.7	25	2.0	3.5	8.6	7.5	2.6	0.8	9.6	25
Sodium (Na)	24	6.2	15	87	154	8.0	37	3.9	208	6.8	172	8.4	1.5	4.1	213	8.8	23
Potassium (K)	3.3			2.8		0.9	3.3	0.6		1.5	6.4	1.0	1.3	4.2	6.7	2.0	6.7
Bicarbonate (HCO_3)	77	32	121	150	90	10	23	4	0†	16	471	164	87	14	518	83	349
Sulfate (SO_4)	16	14	36	91	1,710	2.6	9.8	3.5	50	6.0	19	16	25	17	13	3.1	35
Chloride (Cl)	6.6	4.0	6.4	230	10	10	86	5.9	398	4.5	7.5	8.6	1.1	5.5	25	6.0	28
Fluoride (F)	0.1			0.1	0.0	0.1	0.0	0.0		0.2	1.2	0.0	0.1	0.1	6.4		
Nitrate (NO_3)	0.1	0.0	0.3	31	0.0	0.6	0.0	0.1	0.5	6.5	0.4	3.8	0.4	0.0	0.06	0.2	49
Dissolved solids	126		179	749	2,640	49	204	26	728	67	473	190	113	67	549	105	463
Total hardness ($CaCO_3$)	33	32	111	380	1,530	6.6	64	5.9	140	15	27	150	98	23	9.0	62	352
Specific conductance—*micromhos* (at 25°C.)				1,220	2,700	55.7		36.1	1,430	68.7	766	325	198				
Color				0	1	3				2	4	2	5				
pH				7.5	7.6	6.9	6.0	5.4	3.8	7.2	8.0	7.9	6.7	5.4			
Date of collection	2-5-35	8-4-25	10-6-25	1-20-48	11-23-48	10-4-45	9-23-44	6-21-45	1-24-44	4-16-48	10-8-48	11-18-47	12-19-46	5-22-40	9-14-29	10-23-31	

* Key:

1. Well 850 ft. deep, Chalfont Hotel, Atlantic City, N.J.; Atlantic City Sand
2. Well 981 ft. deep, Whitesville field of Monmouth County Water Dept., near Asbury Park, N.J.; Raritan formation
3. Well 41, Canoe Brook field of Commonwealth Water Co., near Chatham, N.J.; depth 303 ft. in Triassic sandstone
4. Well 558 ft. deep, Kresge Department Store, Newark N.J.; Triassic shale
5. Test Well No. 2, Squires Island, Rahway, N.J.
6. Well No. 2, 162 ft. deep, Lewes, Del.; Cape May formation
7. Artesian well, 135 ft. deep, Martins Lawn Station, Rehoboth Beach, Del.
8. Well 301 ft. deep, Western Electric Co., Baltimore, Md.
9. Well 281 ft. deep, Bethlehem Steel Co., Sparrows Point, Baltimore, Md.
10. Well 54 ft. deep, Salisbury, Md.
11. Well No. 1, 412 ft. deep, Dorchester Water Co., Cambridge, Md.
12. Tap sample, public supply from wells 175 ft. deep, Taneytown, Md.
13. Well 1,030 ft. deep, Frostburg, Md.
14. Well No. 7, 260 ft. deep, Washington Terminal Co., Washington, D.C.
15. Well 717 ft. deep, Suffolk, Va.
16. Well 305 ft. deep, part of public supply, Fairfax, Va.; Wissahickon schist
17. Well 78 ft. deep, Cedarville, Va.; Beekmantown limestone

† Contained free acid equivalent to 8 ppm. H_2SO_4.

by the U.S. Geological Survey, in cooperation with the New Jersey State Water Policy Commission, to keep a close check on the chloride content. These collections are made in April and September in order to reflect conditions before and after the period of heavy pumpage, which corresponds to the large influx of summer visitors. There have been no important changes in the chloride content of the samples collected in the area during recent years. A very real danger of serious salt water contamination exists, however, and development of additional water supplies from the 800-ft. sand will tend to upset the fresh water–salt water equilibrium further, with the result that salt water will penetrate landward at an increasing rate.

Camden is the largest city in New Jersey obtaining all of its supply from wells. The hardness ranges from about 40 to 150 ppm. and averages about 60 ppm. Relatively large concentrations of iron in ground water in the Camden area have necessitated special treatment to prevent excessive concentrations from reaching the distribution mains.

Delaware

Ground water is the only practical source of public water supply for most of the cities and towns in Delaware. Of the 31 water supply systems listed for Delaware by the U.S. Public Health Service, 29 obtain water from wells. The hardness of the ground water supplies ranges from approximately 35 to 130 ppm. for the larger communities and is as high as about 185 ppm. in one small town.

Salt water intrusion in ground water aquifers along the coast is also a source of difficulty in a few places in Delaware. Lewes and Rehoboth Beach have both reported higher chloride concentrations in wells than are normal in these areas.

Maryland

Because much of the population of Maryland is concentrated in large urban areas, and because all the larger cities use surface water, less than 10 per cent of those served by public supply systems obtain water from wells. Salisbury and Cambridge are the largest cities using ground water.

The chemical quality of ground waters in Maryland varies widely. In the piedmont area in the vicinity of Washington and Baltimore, the ground waters are generally soft and contain appreciable quantities of dissolved carbon dioxide and variable, but usually objectionable, quantities of iron. More often than not, these waters are corrosive to plumbing and cause characteristic "red-water" problems.

A resident of Montgomery County recently complained of a white scum on water left standing in pans. This condition, it was stated, was observed only after a new galvanized-pipe plumbing system had been installed. It was found that the scum was a compound of zinc and that the water from the well and storage tank contained 9 ppm. of zinc which had been dissolved from the new galvanized-pipe system.

Shallow well waters in eastern Maryland are usually soft and are low in dissolved minerals. Deep artesian wells, however, although ordinarily very soft, contain relatively large amounts of sodium bicarbonate. These naturally softened artesian ground waters are commonly found in the coastal plains of the Atlantic seaboard from Maryland to Georgia.

Ground waters in western Maryland may be hard or soft, depending on the formation penetrated by the wells. In the limestone valleys, the water will be

relatively hard, varying up to 200 ppm. or more. Wells terminating in crystalline rock customarily yield soft water.

Ground waters in the Baltimore metropolitan area vary widely in chemical quality. Some of the softest waters in Maryland, having very low concentrations of dissolved solids, are found in Baltimore, as illustrated by Analysis No. 8 in Table 3, which represents water from a well 301 ft. deep in the Dundalk district. Another well, approximately the same depth but ending in a different aquifer in the Sparrows Point district, contains nearly 30 times as many dissolved solids (Analysis No. 9, Table 3). It is obvious from the location of the well and the composition of the water that the Sparrows Point well is contaminated with salt water from Chesapeake Bay. Other industrial wells in the Baltimore area also are contaminated with varying amounts of salt water, and some with industrial wastes.

Virginia

The ground waters of Virginia generally follow the quality pattern found in Maryland. Wells in the piedmont usually yield soft water; contain iron, carbon dioxide and relatively large amounts of silica; and are characteristically corrosive. Ground waters in the coastal plains are soft, but the deep waters contain large amounts of sodium bicarbonate. Another characteristic of these deep waters in the coastal plain is their relatively high concentration of fluoride (4).

Near Chesapeake Bay and the Atlantic Ocean, the soft sodium bicarbonate waters are frequently contaminated with salt water. Chloride concentrations as high as 1,000 ppm. are not uncommon. Here, as elsewhere along the coast, the presence of salt water is probably due to the incomplete flushing of sediments containing saline residues of earlier oceanic inundations.

The ground waters in the intermountain valleys of western Virginia are considerably harder than those found elsewhere in the state. The dissolved minerals consist largely of calcium and bicarbonate, which is to be expected in view of the extensive limestone formations in the area. The hardness of the limestone waters ranges from about 100 to 300 ppm., and even higher values are not uncommon.

Many public supplies in Virginia are obtained from springs, Roanoke and Winchester being the largest cities receiving all or part of their supplies from such sources. The hardness of the Winchester supply is about 275 ppm., more than that of any Virginia city with a population greater than 10,000.

Pollution

No discussion of water quality in the eastern United States would be complete without a statement about pollution of the natural water sources. Fortunately, the present trend both in public thinking and in official action is toward alleviation of pollution in streams and underground waters. In some areas of the Middle Atlantic States, the municipal and industrial pollution of streams has become so great that the waters are difficult to treat successfully, particularly during periods of low flow.

In the Camden–Philadelphia area, the Delaware River is greatly overloaded with municipal and industrial pollution, plus the mine wastes and other forms of industrial pollution in the Schuylkill River. It is encouraging to observe, however, that major corrective measures are under way to reduce greatly or eliminate these sources of pollution. Pennsylvania is

engaged in a comprehensive program for cleaning up the Schuylkill River, and Philadelphia is constructing a large sewage disposal plant to provide complete treatment for much of the raw sewage now being discharged into the Delaware River. These activities will produce lasting benefits both to Pennsylvania and to New Jersey.

In the Baltimore area, there is extensive industrial pollution of the ground water aquifers in certain districts. Chromates, copper, free sulfuric acid and other waste materials have been found in samples of ground water near some industrial plants. Studies are being made to determine how far these wastes may be carried through the ground beyond the sources of contamination.

In the Potomac River Basin, there are several areas of heavy pollution. Among the more prominent is the Luke–Cumberland area, where municipal sewage, trade wastes and acid mine drainage produce extremely objectionable conditions, especially during dry seasons, when the normal river discharge is very low. Completion of the Savage River Dam will provide some relief by making possible a higher minimum flow in the river. The only satisfactory improvement of a permanent nature, however, is the effective treatment or prevention of all of these forms of pollution.

The excellent quality of the North Fork of Holston River in southwestern Virginia is drastically altered by the discharge of waste products from a chemical plant near Saltville. The chloride content is increased from a normal concentration of about 2 ppm. to several hundred and, occasionally, several thousand parts per million.

Many other trouble spots could be cited to illustrate the deterioration of natural water sources due to various forms of pollution. It is only through the concerted action of public and private agencies in cooperation with forward-looking industrial leaders that pollution can be reduced to a minimum and the water resources returned to the service and enjoyment of mankind.

Conclusion

The natural water supplies in the Middle Atlantic States are suitable for practically all municipal and industrial purposes. They are generally soft and low in dissolved solids. Most of the available surface and ground waters can be treated with relatively little expense to meet specialized water requirements. Many forms of pollution have threatened to ruin the natural sources of water in some thickly populated and heavily industrialized areas, but there is good reason to believe that the present national, state and local policies of pollution abatement will protect the country's greatest natural resource for future generations.

References

1. Barksdale, H. C. The Ground Water Supplies of Middlesex County, New Jersey. Special Rept. No. 8, New Jersey State Water Policy Commission, Trenton, N.J. (1943).
2. Thompson, D. G. Ground Water Supplies of the Passaic River Valley Near Chatham, New Jersey. Bul. 38, New Jersey Dept. of Conservation and Development, Trenton, N.J. (1932).
3. Barksdale, H. C. Ground Water Problems in New Jersey. Jour. A.W.W.A., **37**:563 (June 1945).
4. Cederstrom, D. J. Geology and Ground Water Resources of the Coastal Plain in Southeastern Virginia. Bul. 63, Virginia Geological Survey, University of Virginia (1945).

Financing Water Works Improvements in Florida

By Townsend Wainwright

A paper presented on Nov. 15, 1949, at the Florida Section Meeting, Orlando, Fla., by Townsend Wainwright, Consultant on Munic. Finance, Wainwright, Ramsey & Lancaster, New York.

THE constitution and laws of Florida prohibit municipalities from issuing bonds for any purpose which will result in the creation of a debt, unless approved by a majority of the freeholders at a referendum in which at least one-half of those qualified vote. Furthermore, even if so approved, a substantial portion of the property of the community—the "homestead" property—will be forever exempt from any tax for the payment of the principal and interest on the bonds. As a practical matter, therefore, raising money for water works improvements must be accomplished by revenue bond financing, which does not require a referendum or the levying of any tax.

This situation is not too great a misfortune, however, since revenue bonds are becoming increasingly popular with all classes of investors. As time passes, many investors are coming to realize that, under certain circumstances, the revenue bonds of a particular municipality may offer better assurance of the punctual payment of interest and principal than do the tax bonds of the same community. This knowledge is not universal, however, and, although the market for revenue bonds is constantly broadening, it is still more restricted than the market for general-obligation tax bonds. The easiest revenue bonds to sell are those of the water system, because it is the one indispensable utility.

There are outstanding in the United States today about 1¾–2 billion dollars' worth of securities in the revenue bond classification, which represents approximately 10 per cent of the total of outstanding obligations issued by the states and their political subdivisions. The bonds of a few of the very large revenue-financed projects, like the Port of New York Authority, command a very broad market, but the great majority of revenue bonds have only a limited market because there are still too many bond buyers who need to be informed of the intrinsic investment qualities of the soundly conceived and operated revenue project. The creation of a broader market for revenue obligations is one of the services that the consultant on municipal finance can and does perform when he undertakes to assist in the raising of money by the issuance of obligations secured by revenues.

A revenue obligation is one designed to be self-liquidating, payable solely from the revenues of the project which it has made possible—that is, the user pays for the financing, operation and maintenance of the service he receives. A water revenue bond, issued to pay for the construction of a water system, is payable only from the charges made to the users of the system.

Problems Involved

There are vast differences, of course, between the problem of raising money to pay for an entirely new system and that of borrowing to extend or improve an existing system, but the essentials are the same. To accomplish the desired result, the prospective purchaser of the bond must be given reasonable assurance that the users of the system, potential or actual, can readily pay the charges for water that are to be imposed, and that those charges will be adequate to meet the costs of operating and maintaining the system, pay the principal and interest on the bonds as they mature and provide certain reserve funds for the renewal and replacement of some of the depreciable properties of the system. Reserves must also be set up for the payment of the service on the bonds in the event of unforeseen contingencies. These are the fundamentally important matters, but there are many other aspects of the security that must be considered, which usually make it imperative for the municipality or authority to have experienced and competent financial counsel and advice to protect the interests of both parties to the loan agreement. Few public bodies are equipped with the knowledge, broad experience and skill required to arrange and bring to market a sound revenue bond issue.

Legal Authority

The first matter to be considered in the issuance of any revenue bond is the question of legal authority. The issuing body must have broad powers to undertake the financing of a project and to furnish adequate security for the bond that is to be issued. The general laws of Florida provide ample authority to create a sound water obligation, and, unless the community charter contains unusual restrictive provisions, it is not necessary to seek the passage of a special act of the legislature.

Engineering Estimates

Next to be considered is the engineering question. At the outset, of course, the consulting engineer must estimate the cost of constructing the project. In a period of relatively stable prices for construction materials and labor, this task would not be too difficult, but, since the end of World War II, the yardsticks used to measure costs have been undergoing unpleasant changes, and figures and estimates that have been painstakingly prepared may have to be revised substantially within a few months. Moreover, projects which may have seemed feasible before the war, or even a year or two ago, have a different look about them today.

Purchasers of revenue bonds are aware of this situation. They have seen the result of underestimates, and they have at times been called upon to take more bonds to complete a project which turned out to be only partially financed, although they had thought the first bite would be enough. Thus, they are going to want to assure themselves of the competence of the engineering talent employed for the job. If the firm happens to be one with which the investors are not familiar, they not only will inquire about, but will have to be sold on, its experience and ability. The securities buyer for a large insurance company who has the responsibility of putting a million dollars or more of his company's money to work in a new project, secured entirely by earnings, must have confidence in the engineers before he recommends the bond to the investment committee.

The engineer is also charged with forecasting the future earnings of the project. If it is new, he must estimate not only what the earnings will be in the first year of full operation, but also what will be taken in for a considerable period of years in the future. To make such an estimate he probably will have to canvass the potential water customers and predict, on the basis of known use habits elsewhere, how much water they will buy. The problem of forecasting earnings, of course, is much simpler if the financing involves a water utility which is in operation and has a record of earnings. The purchaser again will want to be sure, however, that the firm knows its business.

The next thing the engineer must show is the amounts that will probably have to be spent to operate and maintain the system. When these factors have been determined, and assuming that there is a sufficient balance of income available, from reasonable charges for water, to pay the financing costs and leave something over, work can commence on the pattern that the financing will take.

It is now time to call in the financial expert. Unfortunately, perhaps, he may have to be someone from out of town, or even from out of the state, but that does not make him any less necessary to the successful accomplishment of the desired result. If he is properly qualified, the financial counsellor will earn his money. Without the benefit of his services, the obligation will be less attractive to the ultimate buyer, and, even if it is salable, the interest cost to the borrower will be substantially higher.

Work of Financial Consultant

The consultant on municipal finance is engaged to set up the terms of the loan and to give it the maximum degree of marketability. His first job is to become thoroughly acquainted with the community. Later on he is going to have to describe it and indicate the nature of its economy and general financial condition in the official statement or prospectus. After he has obtained the basic data for ultimate presentation to the prospective investor, he will commence the work of setting up the maturity schedule for the new bonds and the other terms and conditions that will give security to the loan. His course might best be described as middle-of-the-road. Since the schedule of payments must be set to discharge the principal of the loan entirely within the period of the useful life of the project, the financial consultant has to know what that is. The length of useful life may differ for each of the facilities and installations to be included in the project. Within limits, the shorter the period of payment, the more attractive the loan may be to the investor, but that may not be the right answer for the people of the community. It is hardly fair to the present generation to burden it with the full cost of retirement of a loan the proceeds of which are to be used to construct improvements that will benefit succeeding generations. Thus, the financial counselor must consider, not only in the maturity question, but in the other terms of the loan, the interest of both parties to the transaction.

Provisions of Indenture

Once he has determined the pattern for the repayment of the loan, the next job of the financial counsellor is to get together with the municipal bond attorney who is to render the approving opinion, so that he can commence drafting the provisions of the indenture.

The entire framework of the loan will be set forth in that document, and the municipal bond attorney must obtain from the financial consultant the outline of the provisions it will contain. These provisions involve, among other things:

1. The amounts and maturities of the loan initially to be authorized and the terms and conditions under which all or a portion of the bonds may be redeemed prior to maturity.
2. The conditions under which additional securities may be issued, either to complete the original project or to extend and improve it.
3. The creation of a sinking-fund reserve, as well as a reserve for depreciation or for renewals and replacements.
4. The creation of a fund into which revenues are to be paid in a specified manner, and the disposition of the revenues for operation and maintenance purposes, for the payment of the debt, for the various reserve funds that may be created, and (if there are excess revenues) for general municipal purposes.
5. Covenants to insure the charging of adequate rates and the continued sound operation and maintenance of the system; covenants on proper accounting and the furnishing of periodic earnings statements and balance sheets, on periodic independent audits, on insurance coverage for the properties of the system, on the securing of deposits; and covenants prescribing the manner in which certain of the funds of the system may be invested.
6. The remedies that will be afforded the bondholder to make it possible to restore the operation of the system to a financially sound basis in the event of the occurrence of a condition of default.
7. The manner in which the indenture may be modified.

All these provisions and others must be incorporated in the indenture to insure a sound and marketable security.

The completion of the indenture and the enactment of its provisions into an ordinance will constitute the necessary authority for making the loan. It will probably have to be accompanied by an appropriate ordinance establishing the amounts of advance deposits and the rates and service charges to be paid by the users of the water system, as well as the necessary measures to enforce the collection of the charges.

Prospectus

After the work on these documents has been completed and official action has been taken, the financial consultant must prepare the prospectus or authorized statement through which the revenue bond is offered to the prospective investor. No attempt will be made to describe all of the things it must contain, particularly since there is no fixed rule on this question anyway. It is, however, a matter that takes great judgment and skill. The experienced financial consultant knows what information and factual data the buyer will require to form a final opinion of the value of the bond.

The essential features of the bond must be fully set forth, which involves careful paraphrasing and often direct quotations from the ordinance. The financial and economic data, both historical and contemporary, must be accurate and must be presented in an orderly manner. Estimates of future earnings and growth must be realistic. No data should be presented which could in any way mislead the buyer. The principal purpose of the statement

is to anticipate any question which the buyer might reasonably ask and to provide the accurate answer. Failure to include pertinent information is nearly as bad as giving misinformation.

The method of presenting the features and circumstances surrounding the loan is extremely important. The technique of proper presentation creates a favorable impression in the minds of the potential investors, and that is money in the bank to the borrower. It seems hardly necessary to mention that it is the ultimate investor in the revenue bond who determines the price at which it sells, not the investment bankers who form groups to bid for the bonds when they are offered for sale. The bankers, of course, must have the information to present the issue to their clients. When the data are furnished through a statement prepared by a qualified financial consultant of known integrity, the same information is available to everyone who might wish to buy the obligation, either wholesale for purposes of resale, or as a permanent investment.

Sale of Bonds

After the prospectus or official statement has been widely distributed to those who may be interested, the final service which the financial consultant should render to the borrower is advice on the conditions and the time of the sale. It is important that the sale be held when the potential buyers have the greatest amount of freedom to bid for the bonds. It is poor business to select a day for the sale when other issues of perhaps greater size and importance may be occupying the bankers' time and efforts. If there is a heavy supply of bonds on the market, it will be wiser to wait until the supply is reduced and dealers are not overstocked with inventory that they are having difficulty in selling. Sometimes it is advisable not to sell bonds immediately prior to or during a holiday period, when the buyers may be away from their offices. There are other market questions concerning the terms under which the securities should be offered for sale. Advice on these points can make an important difference in overall interest costs and should be obtained from the experienced financial consultant.

Conclusion

It will be realized that the financing of water works improvements in Florida—or elsewhere, for that matter—through the sale of revenue bonds is not a job for amateurs. To bring the sale to a successful conclusion, three types of professional services are required: a recognized bond attorney, to draw the proceedings and to issue the approving opinion, without which the bond cannot be marketed; a qualified firm of consulting engineers, to design and supervise the construction of the project and to obtain certain of the basic data necessary to the financing; and a qualified financial consultant, to "custom-tailor" the loan, to provide the appropriate information which the investor will require and to give the municipality the benefit of his experience and judgment in connection with the many details necessary to get the money on the most favorable terms possible.

Development of Chester's New Water Supply

By Francis S. Friel

A paper presented on Sept. 15, 1949, at the Pennsylvania Section Meeting, Harrisburg, Pa., by Francis S. Friel, Pres., Albright & Friel, Inc., Philadelphia.

IN securing a new water supply for Chester, Pa., it was necessary to study all possible sources in the region in order to select the most practical and economical. The watershed area or areas to be developed had to produce 20 mgd. of high-quality water at the outset and to be capable of development to meet the future requirements of the service area of the Chester Municipal Authority, which it is estimated will exceed 30 mgd. in the year 2000.

A study was made of all reports on a new water supply which had previously been submitted to the Chester Municipal Authority and to the former owners, the Chester Water Service Co. Furthermore, sites for the construction of dams and impounding reservoirs on streams which were heretofore considered for water supply were inspected, and preliminary construction and annual operation cost estimates for the various sources were prepared.

The investigation included a study of the pollution of the present source—the Delaware River—and the effect of the antipollution laws of Pennsylvania upon this river. The engineering staff investigated, studied and analyzed seven sources of supply: Ridley, West Branch Chester, Brandywine, Octoraro, Red Clay, White Clay and East Branch Chester Creeks.

The scope of the work included population and demand studies for the past, present and future; rainfall, runoff and stream flow studies of the sources considered; and also a water quality survey embracing mineral, chemical and bacteriological analyses. An investigation was made of the private, municipal and industrial pollution loads on the various watershed areas considered, and population estimates were made for them.

After reconnaissance and some topographical surveys of the sites for dams and impounding reservoirs and of conduit routes, alternate preliminary designs for the dams were prepared. Dam sites were investigated from a geological viewpoint, and studies were made of the hydrology, including the watershed yields and the compensating release waters required.

Alternate preliminary designs for water filtration plants were prepared, and economic studies of the water pumping problem, embracing the use of electric, steam and diesel power, were made. The investigation also included the preparation of estimates covering capital and operating costs and the increased water rate which would result from the adoption of the program. A search of prior water rights was undertaken, since this factor was important in determining the compensating waters to be released.

Consideration was given to the Chester Municipal Authority service area's projected requirements for the year 2000, as well as to the financial resources of the authority, for economics was always foremost.

In the course of its study the engineering staff necessarily had to give full consideration to the benefits and disadvantages of the existing water supply, purification, storage and distribution system facilities. The importance of utilizing the existing installations as far as possible was not overlooked.

The present supply of the Chester Municipal Authority is taken from the Delaware River at a point approximately ½ mile southwest of the principal mercantile district of Chester. The existing filtration plant and pumping station are equipped with low-lift pumps, mixing chambers, sedimentation basins and ten rapid sand filters with a capacity of 12 mgd. The distribution reservoir which rides on the system is located on Harrison Hill, about 3 miles northwest of the city. This reservoir is divided into two parts and has a maximum capacity of 17.8 mil.gal. and an operating capacity of 14.5 mil.gal.

The population served by the Chester Municipal Authority increased from 9,485 in 1870 to approximately 100,000 in 1945, the present average water demand being approximately 11.5–13 mgd.

The raw water now drawn from the Delaware River is grossly polluted, which throws a serious burden upon Chester's filter plant. At present Philadelphia discharges 330 mgd. of raw and partially treated sewage into the Delaware and Schuylkill Rivers, although projected sewage treatment plants will mitigate the situation to some extent. In addition, other municipalities and the industries along the Schuylkill and Delaware Rivers likewise contribute to the pollution, which makes the present condition of the river unsatisfactory. It would not be rash to state that the Delaware at Chester is probably one of the worst polluted rivers in the United States.

The salinity of the water in the Delaware River must also be considered. When the river flow is above normal, the salt content in the vicinity of Chester is low. In dry years, however, it is quite high, and there are times when the chlorides in the water reach enormous proportions.

In 1930 the U.S. Supreme Court granted New York City the right to divert 440 mgd. from the river, subject to the provision that the city release sufficient water to restore the flow of the Delaware River at Trenton to 3,400 cfs. With that condition met, the salinity of the river at Chester would be approximately 400 ppm. in terms of sea salts and 220 ppm. in terms of chlorides.

The watershed area available on Ridley Creek was 27½ square miles, and an 8-bil.gal. storage reservoir could be constructed. After deductions for evaporation, a yield of 16 mgd. might be expected, but, allowing 2 mgd. for the Borough of Media and 7.1 mgd. for compensating waters, the net safe yield would be only 6.9 mgd.

On the West Branch of Chester Creek, the watershed area available was 18 square miles and the reservoir capacity was only 4.5 bil.gal. A yield of 10 mgd. was estimated, but, after deducting compensating water, the net safe yield was only 5.35 mgd.

Combining the two creeks, the total net safe yield was only 12.25 mgd. These calculations were based upon a 75 per cent utilization of the stream and dry weather conditions which existed in the period May 1930–July 1933. For a 20-mgd. yield, 100 per cent stream utilization would be required, but utilization in excess of 75–80 per cent appears to be uneconomical. Compensating waters for release from

proposed reservoirs were based on 0.4 cfs. per square mile of watershed.

Studies on Brandywine Creek indicated that a dam on the East Branch could impound 1.07 bil.gal. A watershed area of 127 square miles would insure a yield of 20 mgd. It was determined that sufficient water could be obtained for Chester in addition to the requirements of Wilmington (stated as 22 mgd.), plus quantities for future demands. The water in this creek is highly polluted, however, and there are many pollutional hazards of uncertain potential volumes and concentrations.

Red Clay Creek (with a drainage area of 28.4 square miles), White Clay Creek (with 61 square miles) and Big Elk Creek (with 28.5 square miles) watersheds are contiguous. Of these three, only White Clay Creek could be used individually, but that was considered unsuitable because of its limited drainage area and the cost involved in constructing the facilities required to produce sufficient water. A combination of the three likewise appeared undesirable.

As Octoraro Creek watershed is contiguous to the Big Elk area, no great increase in the length of the supply conduit was required to reach this much more desirable source. The total watershed area above the Pine Grove dam site is 139½ square miles, and the storage capacity of the Chester-Octoraro lake, now under construction, is 2.5 bil.gal. The large drainage area, in combination with the reservoir, will yield 30 mgd. during a dry period similar to 1930–33. With sufficient storage, the Octoraro could yield 75 mgd.

All streams which were considered as possible water sources were studied from a sanitary viewpoint. The Ridley Creek watershed area is sparsely settled; no large population densities exist on this watershed, and the only industrial plant, a dairy, had been abandoned at the time of the investigation. Sanitary tests indicated that normally the creek was satisfactory as a source of supply. As the West Branch of Chester Creek is also sparsely settled, its water quality was likewise found satisfactory.

Brandywine Creek, in its upper reaches, consists of an east and a west branch, the former rising north of Downingtown and the latter north of Coatesville. East Branch receives the discharge of treated sewage from the entire Borough of Downingtown, with a population of 4,600, and about one-half of the treated sewage of West Chester, with over 13,000 inhabitants. West Branch receives the treated sewage from both Coatesville and South Coatesville, with populations totaling more than 14,000.

In addition to domestic pollution, East Branch had, at the time of the investigation, 19 major industrial plants, including two abattoirs, four dairies or milk plants, one rendering plant, one textile mill, six paper mills, two oil handling or purification plants, one penicillin and one chemical plant, and a quarry. West Branch had ten major industrial plants, including one milk plant, one packing plant, two paper mills, three steel plants, one textile mill, one oil purification plant and one cannery.

With these many potential hazards, it was not surprising that the pollution load was high at the point of confluence of the two branches. Tests made in July showed the population equivalent to be 30,000 and 38,000, respectively, on the east and west branches, for one day; and for another day, 16,000 and 48,000, respectively. Comparative coliform indexes were 10,000 and 50,000 the first day and 1,000 and 100,000 the second. It was also noted, at the times of sampling, that the flow in the

Brandywine was 65 per cent above the 33-year average, twenty times the minimum recorded flow and six times the minimum five-month average.

As these high pollution results were obtained under stream flow conditions far more favorable than the average, it was felt that major problems of controlling pollution from the many industries along the stream would result. Taste and odor difficulties would be certain to cause headaches. The modern outlook on problems of water supply, from the sanitary and aesthetic viewpoints, does not favor the use of a stream as badly polluted as the Brandywine, particularly when some other source is available.

The Octoraro Creek watershed was sparsely inhabited, being chiefly an agricultural area. Sanitary tests of Octoraro water showed it to be relatively unpolluted, with a good oxygen balance and low in color, hardness, carbon dioxide, total solids, ammonia, oxygen consumed and coliform index. The algae types present were those natural to streams of good quality, in complete contrast to the conditions in Brandywine Creek. Tests indicated that the water could be easily coagulated and purified by conventional treatment methods.

Studies of all these creek waters confirmed the conclusion, so often reached in recent years, that no stream water in densely populated states is suitable for a public supply, or will satisfy the needs and desires of the modern way of life, without purification, including filtration.

Based upon the facts developed in the investigation, it was concluded that:

1. The Delaware River should be abandoned as a source of water supply.

2. A new water supply should be capable of producing not less than 20 mgd. during dry-weather flow periods.

3. The quality of water in Ridley and Chester Creeks was satisfactory, but a sufficient quantity was not available in these two combined streams to supply more than 12.25 mgd. during a dry period.

4. The water in Brandywine Creek, in its present condition, was not desirable for a new source of supply for Chester because of the pollutional load and the objectionable tastes and odors which might result from trade wastes.

5. Sufficient water was not available in Red Clay, Big Elk and White Clay Creeks to supply present and future water requirements.

6. Both the quantity and quality of the water in Octoraro Creek made it suitable as a new source of supply.

7. A filtration plant is required for any new inland source of water supply.

8. The water from a new source of supply should be pumped electrically.

9. It was not feasible to secure a ground water supply sufficient in quantity and quality to meet the demands of Chester.

Proposed Facilities

With these facts and conclusions at hand, the Chester Municipal Authority adopted the plan for the development of Octoraro Creek. The facilities, now under construction, will consist of: [1] Chester-Octoraro Dam, which will impound 2.5 bil.gal. of water; [2] an 18-mgd. filter plant and pumping station; [3] 38 miles of 42-in. force main and 39-, 36- and 30-in. gravity transmission lines from Octoraro Creek at Pine Grove to the existing Harrison Hill Reservoir in Chester; [4] duplicate, covered reservoirs at Oxford Summit, with a total capacity of 5 mil.gal.; and [5] duplicate storage reservoirs at Village Green, total capacity 20 mil.gal.

Briefly, the proposed facilities are designed as follows:

The water flows by gravity from the Chester-Octoraro lake to the filter plant, entering through a 42-in. cast-iron pipe leading to a screen well. The elevation of the water in the screen well is controlled by a butterfly valve. A continuous traveling screen is provided for the removal of leaves and trash, with continuous cleaning by water jets under high pressure. After passing the screen, the water flows by gravity to three high-speed "flash" mixers, each 6 ft. square, with a theoretical detention period of 30 seconds.

The two slow mixing basins following the flash mixers are equipped with longitudinal type mixing apparatus, the dry well for chain drives being placed approximately midway between the influent and effluent ends of the basins. The water passes under the bottom of this dry well, which is about 3 ft. above the basin floor and acts as one of the over-and-under baffles. The variable-speed mixers are equipped to produce peripheral speeds of 1.2–0.6 fps. on the 12½-ft.-diameter paddles. The basins and equipment are designed for tapered mixing and are 14 ft. wide by 97 ft. long, with a 13½-ft. water depth. Each basin will provide 21 minutes of mixing.

The water flows by gravity from the mixing to three settling basins, each 73 ft. 9 in. in width and 152 ft. long, with sloped bottoms leading to cast-iron drains. The minimum water depth is 12 ft. Based on an 18-mgd. design capacity, the detention time is four hours. The mean forward velocity in these basins at rated capacity is 0.63 fpm.

There are six 3-mgd. filter units, each consisting of separate sections on opposite sides of a common supply and waste gullet. Each filter section is 16 by 34 ft. and is equipped with Wheeler filter bottoms cast in place. The filter media are 12 in. of gravel and 27 in. of sand, with a 27-in. freeboard to overflow. The concrete wash water troughs are spaced 6 ft. 10 in. apart, center to center.

Automatic air-float filter effluent controllers, with central rate control, operate on clear-well elevation but independent setting is provided. The two sections of each filter unit have connected effluent piping, with a single-rate controller of 3.0-mgd. capacity, discharging through the pipe gallery floor to a flume which conveys the water to the far end beneath the filter gallery before entering the clear well under the filters, thus securing the maximum detention. When pH correction or other treatment is introduced in the filter effluent flume, the detention period of 50 minutes will be of real value.

A 250,000-gal. wash water tank, built on a hill adjacent to the filter plant, is 40 ft. in diameter with a water depth of 27 ft. The maximum water level is 56 ft. above the wash water troughs and the tank bottom is 29 ft. above them.

There are five chemical feeders—one for alum, one for lime, two for carbon and one spare—which are filled by gravity from overhead storage hoppers. Two chlorinating machines are provided, with space for a third if required. Provision has been made for numerous dosing points, allowing ample flexibility in the choice of treatment.

A thoroughly modern laboratory is located in the filter plant, with separate bacteriological and chemical rooms, special sterilizing lights in the bacteriological room and many unusual features which are found in industrial laboratories but have been very slow in reaching the public sanitation field.

It has been estimated that coagulation with alum will require an average dosage of 120 ppm. and that 4.3 ppm. of lime will be used for pH adjustment.

The chlorine requirement is estimated at 0.7 ppm., with an ammonia application of no more than 0.2 ppm. Carbon for taste or odor control is expected to be in demand only seldom and for limited periods. It will be needed merely to remove the products of algae growth or decomposition. The control of algae growths is estimated to require 20 lb. of copper sulfate per million gallons of storage per year in the upper 20 ft. of the reservoir water.

As previously noted, the water flows from the reservoir to the filter plant by gravity, and the high-duty pumps which lift the water to the system are horizontal, centrifugal, motor-driven pumps in series, with bottom suction and side discharge. An electrical, hydraulically operated cone valve is located on the discharge line of each pump, with another on the 42-in. discharge main in the throat of the venturi tube.

The pumping station, which has a total capacity of 36 mgd., is equipped with four pumps of 6-, 8-, 10- and 12-mgd. capacity. The capacities selected permit a pumping range of 6–36 mgd. in intervals of 2 mgd. When the pumping demand is low, instead of shutting off individual filters, the rate through the six 3-mgd. units will be reduced by multiples of 2 mgd., thus synchronizing the production of water with the pumping requirements.

Attention is called to several items of interest which were utilized in the design of this pumping station. The first is the absence of piping on the pump floor. A pipe gallery has been provided in the basement below, which makes possible a structure of minimum size and pleasing appearance. Provision is also made for a trolley beam equipped with a hoist, located over the centerline of each unit, which facilitates removal of the pump casings and maintenance of the equipment. On the discharge from each pumping unit are cone and gate valves. The interior ceiling of the station is lined with acoustical material.

The switchgear for the electric motors is of the totally enclosed, dead-front, metal-clad type and consists of a box structure containing circuit breakers and associated equipment—such as instrument transformers, buses and connections—and individual sections holding motor starters and feeder circuits.

The station has been laid out in such a manner that in the future, when required, the 6-mgd. unit which will now be installed can be replaced by a 14-mgd. unit, thus providing a total pumping capacity of 44 mgd. This pumping arrangement will make possible the enlargement of the filter plant up to 50 per cent of its present design capacity without adding more pumproom space.

The Chester-Octoraro dam and the filter plant are now under construction, and the building of the 38-mile line to Chester will start in 1950. It will consist of a 42-in. force main from the filter plant to the Oxford Summit reservoirs—these to be duplicate, covered structures, with a total capacity of 5 mil.gal. From these reservoirs, the water will flow by gravity through a transmission line of 39- and 36-in. diameter to the Village Green covered storage reservoirs, also constructed in duplicate, with a capacity of 20 mil.gal. From Village Green, the filtered water will flow through a 30-in. transmission line to the existing Harrison Hill Reservoir, making connection with the present distribution system en route. The pipeline has a 20-mgd. capacity with gravity flow. A future booster station, which will be constructed at Oxford when needed, will increase the capacity to 30 mgd.

Operation and Maintenance of Small Water Systems

By L. H. Lutz, D. W. Jones and H. L. Berkstresser

A panel discussion presented on Nov. 15, 1949, at the Florida Section Meeting, Orlando, Fla., by L. H. Lutz, Supt., Light & Water Dept., Ocala, Fla.; D. W. Jones, Supt., Water Dept., North Miami, Fla.; and H. L. Berkstresser, Supt., Water & Sewerage Dept., Panama City, Fla. This discussion exemplifies the serious problems of water works executives in small communities and demonstrates their ingenuity in coping with them.

Ocala Water System—*L. H. Lutz*

THE Ocala, Fla., water system serves approximately 12,000 people in and around Ocala and is operated in conjunction with the electricity department. The amount of water pumped averages 1.75 mgd., which leaves the plant at a pressure of 81 psi. and is distributed through mains up to 12 in. in size.

According to reliable information, the first lines were laid before 1890. Cast iron is used on all sizes above 2 in., except for a recent installation of asbestos-cement pipe. It has been found that cast-iron pipe with mechanical joints can be laid much faster than the bell-and-spigot type. On long runs, ditches are dug with a machine. Mains are laid with at least 30 in. of cover. New lines are treated with a solution of calcium hypochlorite and are flushed after several days, samples being taken to determine whether they are free of contamination.

Installation Methods

Construction beneath state highways and railroads is not undertaken without first receiving properly executed agreements. No attempt is made to wash a line under such a crossing. When a railroad is involved, a ditch is worked as close as possible to the track and a conduit is jacked under at the required depth. Bridge or river crossings do not form a part of the system, because the nearest stream is about 6 miles away.

Where the soil is free of rocks, galvanized pipe as large as 2 in. is driven by means of a 3-ft. length of 3½-in. shafting fitted with a 1-in. stem to enter the pipe. The device slides on a plank, being jerked against the pipe by two men with hand lines, while a third man directly back of the driver pulls it in position for another stroke. This method has been used on distances greater than 75 ft.

Distribution System Difficulties

Many new homes connected to a 6-in. dead-end main experienced excessive pressure reduction during periods of heavy consumption. As the building program continued, the trouble grew

worse. Pressure readings were taken along the line between the hours of 2 and 4 A.M., while a uniform flow was established by opening a fire hydrant at the dead end. A large difference was noted in two readings within 50 ft. of each other. The pipe was uncovered and a valve with a broken stem was found under a street that had been paved many years previously. There was no valve box and the gates were three-fourths closed. Replacement resulted in a satisfactory flow. In several instances, low pressure has been traced to closed valves in the system even when the water was fed from several directions.

During a WPA improvement program several sewer manholes were built across cast-iron water mains, a fact which was not discovered until 1949, when the pipe cracked from the strain caused by the brickwork settling. The flooded manhole made repairs impossible without main contamination. An engineer from the state board of health was called and within a few hours was on the scene with recommendations which proved very helpful. A high chlorine residual was maintained until samples taken from the vicinity were reported to be bacteriologically satisfactory.

On another occasion a small bottling plant developed refrigeration trouble. The ammonia pressure was higher than the water pressure, and, because of improper operation of the valves, the ammonia was forced into a 6-in. main serving the south section of the city, including the hospital. As the owner of the plant had locked the building when the trouble developed and had failed to make known the problem, many fire hydrants had to be flushed before all traces of ammonia vanished.

Most distribution system difficulties develop underground, but Ocala experienced one at an elevation of 183 ft. Only two days after an inspector reported that the roof of an elevated tank was resting on the upper edge of the structure, a windstorm lifted the cone of steel, which has a base 30 ft. in diameter and weighs over three tons, and dropped it into a nearby backyard. No time was lost in replacing the roof, because the exposed spider rods might provide a roost for birds. Steel plates $\frac{3}{16}$ in. thick were butt-welded together to the tank by $\frac{3}{8} \times 4$-in. cleats on 3-ft. to form a new roof, which was secured centers, extending 4 ft. below the upper edge to reinforce the top ring against deterioration at the fluctuation point of the water level.

North Miami Water System—*D. W. Jones*

In 1945 it became apparent that the North Miami area would soon be faced with a building boom second to none in Florida. At that time the water system, after numerous changes and additions in former years, included a lime treatment plant of the fill-and-draw type; an elevated tank with a 60,000-gal. capacity; two pressure filters; and three concrete settling and storage tanks. The distribution system consisted of small, poorly arranged lines in several subdivisions, tied together with three 6-in. lines. This system was serving about 850 units scattered over several square miles (including the Village of Biscayne Park), but covering only a minor portion of the entire town area. The water supply was taken from wells 40–60 ft. deep.

Expansion of System

As the town area extended from the mangrove marshes of Biscayne Bay, over the coral rock region paralleling the bay and into the sandy high ground to the west, the growth of the distribution system meant negotiating railroad tracks, tunneling the federal highway and crossing canals and a muck area of about ½ mile. Funds from the first issue of water revenue certificates, in the amount of $200,000, became available in 1946 and work was begun in June, the first objective being the tying together of existing lines and necessary new ones in a systematic manner.

As this work progressed, and even before new plant construction was begun in August 1947, it became apparent that more money would be needed. Negotiations were undertaken for an additional $200,000. By this time North Miami was well on its way to becoming the fastest growing municipality in the United States. In support of this claim it may be noted that building permit figures rose from $20,814 in 1944 to $10,504,230 in 1949 (up to October 1). There were periods when the amount of building permits exceeded those of Miami Beach and Coral Gables, and the construction was almost entirely residential.

Extending the distribution system fast enough to permit the approval of this much building presented quite a problem. The new plant was completed in 1948 and put into operation, after some redesigning, as a 2-mgd. unit, instead of the 1-mgd. originally planned.

Early in 1949 one area within the town, about 2 miles from the previously populated residential section, burst into building activity with a resulting 1,500 homes. Water service had to be provided at a maximum departmental expenditure of only $35,000. An existing 6-in. line was extended into the heart of this area. At the terminal, a 200,000-gal. storage tank was constructed, as well as a small booster station. The service lines within the area were laid according to departmental specifications and designs and were paid for by the developers. These lines are supplied with water through the 6-in. main, and at slack times a solenoid valve opens at a set pressure and admits water into the ground storage tank. During periods of peak load, three pumps of different sizes, installed at the booster station, take suction from this tank as the pressure drop in the line necessitates, maintaining the required service pressure. It was found that during the slack hours of the morning and night sufficient water to fill the tank was available to meet the peak demand. This system has proved trouble-free since its operation was begun in August 1949, and it will supply the area mentioned satisfactorily until additional lines can be financed and installed.

Main-Laying Problems

The expansion of the North Miami system has produced a number of interesting problems. A small muck area, approximately ½ mile wide, had to be crossed by a 6-in. asbestos-cement line. The pipe was laid in a shallow trench, probably not more than 12–18 in. deep, as the water table was near the surface, and also to avoid a fill of 2 or 3 ft. to make a stable foundation. Everything seemed to be satisfactory, and the line was checked, chlorinated and put into service. Following a severe dry spell of three or four months

the water table dropped and the muck dried out. One day, shortly after a severe surge on the line, it was noticed that the flowmeter charts had taken a sudden rise. The line was inspected and was found to be above the ground for four or five lengths. The explanation was that the dry muck did not have sufficient weight to keep the line in the ground. Repairs were made and fill was deposited the full length of this run in order to provide additional coverage.

Tunneling beneath the federal highway and railroad tracks was accomplished by the use of a large ratchet jack to push a 20-in. casing. A handmade earth auger cut and removed the dirt from within the casing. An automobile bumper jack was used to push the auger into spots where rock was met. A period of three days was required to traverse 70 ft.

When acid and salt soils were encountered, asbestos-cement pipe was employed, as it was found easy to handle and could be laid quickly. A mile and one-eighth was laid by six men in three days, including the time needed to transport and distribute the pipe along the trench. It was learned that all joints had to be absolutely tight, because the smallest leak under the gaskets would eat away the pipe in that area and cause trouble.

A canal 120 ft. wide was crossed on four bents of two pilings each. The 6-in. steel pipe with welded joints was fabricated on the banks and, when completed, was lifted into place by an 85-ft. crane. This crossing was 16 ft. above the mean low-tide mark.

Plant Facilities

The North Miami plant now consists of a pumping station built upon a clear well of 70,000-gal. capacity. The three existing ground storage tanks, capped to uniform height, with a combined capacity of 350,000 gal., float on the clear well, controlled by a hydraulic valve actuated by the water level within the well. The pumphouse contains the laboratory and electrical control panel, one 1,500-gpm. and two 750-gpm. service pumps, and backwash and transfer pumps, as well as a carbon dioxide generator and air compressor. An Infilco "Accelator," with a 2-mgd. capacity, is mounted in a concrete tank adjacent to the chemical storage house. The two original pressure filters, with three additional units, are mounted in the rear of the pumphouse. The aerator is located on the concrete roof of the chemical storage house.

With this layout, the water flows by gravity into the Accelator, from there to the recarbonation tank, through the filters and flow rate controller, and into the clear well. The operation of all pumps and appliances used throughout the plant is as nearly automatic as possible. Two men constitute the operating force and make a nightly inspection.

The number of services is fast approaching the 4,000 mark. The gross income for 1949 will be in excess of \$118,000, which is amply sufficient to meet all charges.

The construction of this entire unit by town forces working under the water superintendent, aided by the cooperation of the consulting engineers in redesigning some parts of the plant, has resulted in a saving of more than \$100,000, as compared with bids received on the work from private contractors.

Panama City Water System—*H. L. Berkstresser*

Panama City, Fla., is served by the 4-mgd. St. Andrews plant and the 1.2-mgd. Millville plant. The former employs aeration and chlorination, while the latter also uses these methods, together with sedimentation and filtration.

In April 1944, when the author assumed his present position at Panama City, the Millville plant had a rated capacity of 1 mgd. Investigation soon disclosed, however, that the three shallow wells which were the source of supply would not produce this amount of water. Another well was therefore dug, with a rated capacity of 350 gpm., or approximately 0.5 mgd. The addition of this fourth well increased the hardness of the water from 115 to 156 ppm. as $CaCO_3$, requiring a change in the lime dosage to bring the hardness down to about 90–95 ppm. Because the sedimentation basin was very small, it became necessary to drain and wash it out more often as a result of the greater quantities of sludge.

Need for Plant Expansion

The system proved adequate until the end of the war. Then, instead of becoming a "ghost town," the city began to grow by leaps and bounds. Tyndall Army Air Field was made a permanent air university and the International Paper Co. plant has doubled its capacity. Today Panama City has an estimated population of 30,000. Since 1947 an average of 40 new water accounts has been added each month. The big problem was to find the money to pay for extending the distribution system and purchasing meters to meet the increased demand.

During the dry months of April and May 1948 an unprecedented peak load was encountered. With no funds available to install a water main large enough to utilize the 4-mgd. plant at St. Andrews, located approximately 3 miles from the city, it became necessary to add a clear well to the Millville plant. The operation of an additional 700-gpm. service pump during the peak load hours of 3–8 P.M. doubled the rate at the Millville plant. In 1949 a normal pressure was maintained in April and May, but the population continues to rise and the increased demand is already beginning to take effect.

The original clear-well capacity was 100,000 gal. Economic conditions and lack of space made it necessary to confine the capacity of the new clear-well reservoir to 300,000 gal. and to locate it as near the old clear well as possible. The two were interconnected by a 12-in. line, which was also connected to the main distribution system. A valving arrangement made it possible, during off-load periods (between midnight and 5 A.M.), to shut down the Millville plant and take care of the demand with the St. Andrews facilities. The new reservoir could also be filled from the St. Andrews plant so that it would be ready for the following day's peak load.

The design of future installations and the proper grid to obtain the maximum benefits has been a subject of considerable study. The cost of the new mains that will be needed in the next five or six years to utilize the larger plant at St. Andrews, plus the cost of supplying the Millville plant with additional wells and filter capacity and an elevated tank, will amount to a total of more than $500,000.

Distribution System Maintenance

To maintain any distribution system properly, it is vital to install enough valves to keep at a minimum the number of customers cut off during breaks or interruptions of service. At Panama City, it was found that the discontinuance of service in any part of the downtown area necessitated the closing of so many valves that practically the entire business section had to be shut off to make any kind of repair. The installation of eight 6-in. valves under pressure with a valve-inserting machine made it possible to repair broken stems in the other valves so that shutdowns could be confined to a single block.

The maintenance of valves in the distribution system is truly a "must," especially in the main transmission lines. These valves should be operated at least once a year to check the packing glands. Such inspection will disclose a surprising number of leaking valves. Closing the gate valves and then opening them two or three turns, giving time for the increased velocity of the water to wash the gate channels clean, will be found helpful in making the valves seat properly and hold better.

It may be of interest to describe Panama City's method of handling complaints from customers about low pressure on house services. Most of these complaints come from locations where there are old ½-in. service lines which are badly tuberculated. As a result, the opening in such lines is much less than ½ in. in diameter. An elevation sketch is made showing the number of feet above ground level the highest tap is located. A gage is placed on the frontyard spigot and a reading taken with no water being used, which gives the static head. The pressure reading, when converted to feet of head, shows the customer that there is enough pressure for the water to reach above the highest tap. Then a spigot in the kitchen or bath is opened and the drop in pressure, converted to feet, indicates the point to which the column of water will drop. If a two-story house is involved, the elevation usually falls to the same point as the highest tap and often below it. By this means, it is easy to convince the customer that his trouble is due to a constricted pipe opening. The replacement of the old service with a new and larger size of pipe will eliminate the difficulty. It is explained to the customer that, if he doubles the size of his service, he will receive more than four times his present volume.

The Small-Scale Manufacture of Bleaching Powder in Backward Areas

By Ralph Stone

A contribution to the Journal by Ralph Stone, San. Engr., Institute of Inter-American Affairs, Bogota, Colombia.

THE backward areas of the world are in great need of an economical sterilizing agent for water supply and allied uses. Typhoid fever, cholera, amebic dysentery and other diseases often abound partly as a result of the nonavailability of chlorine gas or chlorine compounds for disinfecting polluted water and food. As transportation charges in such regions are high, the local production of chlorine may be more practical than its importation. This paper describes the author's experience in the construction of a small bleaching-powder (calcium oxychloride) plant while employed as a sanitary engineer in the interior of central China by the United Nations Relief and Rehabilitation Administration (UNRRA).

The work was performed at Shaoyang, Hunan Province, in conjunction with a UNRRA-sponsored project called the Agricultural Industries Services. The purpose of the project was, first, to assist in the relief and rehabilitation of small industries disrupted by the Japanese invasion and, second, to develop small industries which would be helpful in building up the economy of an agricultural region.

There are few bleaching-powder plants in China. In fact, chlorine in gaseous or compound form is expensive and difficult to obtain even in the coastal cities of China. Because one of the purposes of the Agricultural Industries Services sanitation program is to make improvements based, as far as possible, on the use of local materials, a small, simple type of bleaching-powder plant was designed and built.

Several months of experimentation were required to determine the most efficient methods of manufacturing and handling chlorine. Laboratory pilot plants were constructed for simple tests in manufacturing gaseous chlorine, bleaching liquor and, of course, bleaching powder. It was finally ascertained that the most satisfactory way to handle the chlorine was in the form of bleaching powder and that entirely local materials could be employed in its production.

Manganese dioxide and common salt are mined near Hsiang Hsiang, a distance of 85 miles from Shaoyang, and there is an A.I.S. sulfuric acid plant in Shaoyang. With these materials chlorine gas can be generated, and bleaching powder can be produced by the direct chemical combination of the chlorine gas with locally made slaked lime.

The equations for the reactions involved are:

$$MnO_2 + 2NaCl + 2H_2SO_4 \rightarrow Cl_2 + MnSO_4 + Na_2SO_4 + 2H_2O$$

$$Cl_2 + Ca(OH)_2 \rightarrow CaOCl_2 + H_2O$$

The proportions of the chemicals required can be worked out from their

molecular weights. Actually the bleaching powder contains only about 68 per cent calcium oxychloride ($CaOCl_2$), the remainder being calcium hydroxide and water. When the bleaching powder is dissolved in water, the calcium oxychloride decomposes to provide calcium hypochlorite and calcium chloride:

$$2CaOCl_2 \rightarrow Ca(OCl)_2 + CaCl_2$$

The calcium hypochlorite is, of course, the compound used in disinfection.

Bleaching-Powder Plant

The two principal sections of the bleaching-powder plant are the chlorine gas generator and the absorption chamber. The generator consists of a sulfuric acid tank, chemical reaction tank, open water boiler, foam trap, desiccator and the necessary pipe connections. The sulfuric acid and chemical reaction tanks, the desiccator, and all the piping are made of ¼-in. lead. The sulfuric acid tank is a cube with a 1½-ft. side. The chemical reaction tank, also a cubic structure, with a 2-ft. side, is placed over the open water boiler, which is heated by a small coal furnace. The furnace heats the water, which, in turn, gently warms the chemicals placed in the tank, accelerating the reaction. The amount of chlorine gas production can thus be controlled

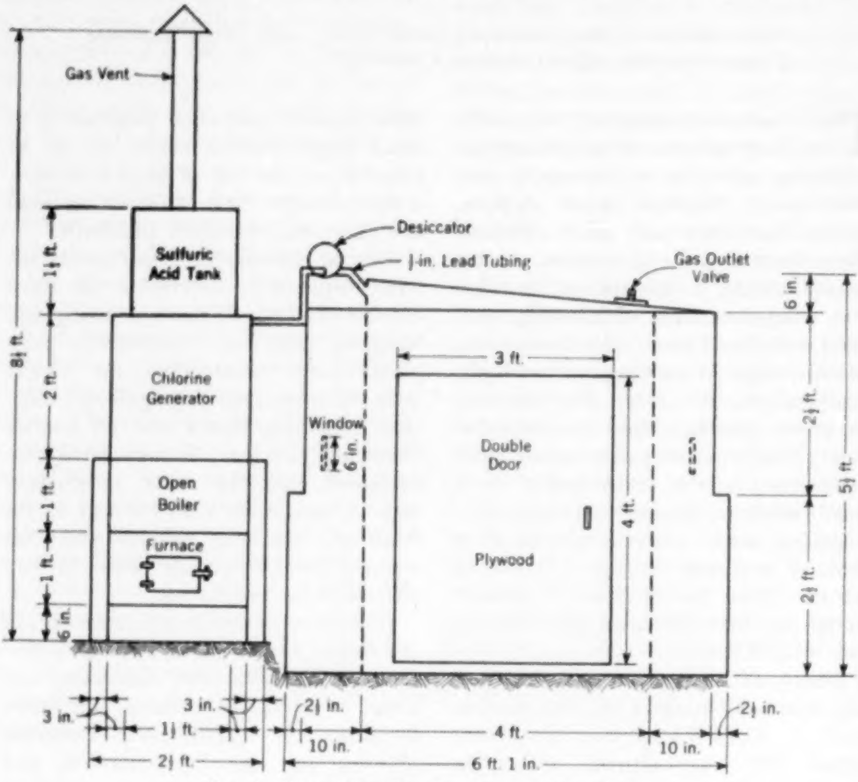

FIG. 1. Bleaching-Powder Plant (Elevation)

by the heating operation as well as by the rapidity with which the sulfuric acid is fed. A lead needle valve in the sulfuric acid tank regulates the rate of flow into the chemical reaction tank after a proper loading of common salt and manganese dioxide has been placed in it. The chlorine gas thus generated passes through the combined foam trap and wash bottle by means of gas pressure. Any waste hydrochloric acid is absorbed in the water. The chlorine gas then travels into a desiccator containing iron scraps, where it is dried before being discharged into the absorption chamber (Fig. 1 and 2).

The absorption chamber is constructed of brick and cement, with a lapped-joint plywood roof. The inside wall is made of firebrick to resist chlorine corrosion. Also the absorption chamber is lined with tarpaper and asphalt throughout. Special care was taken to calk the roof joints with neat cement and asphalt and to cover it with a double lining of tarpaper. Two 6-in. square windows were placed in the walls of the brick chamber so that the contents could be observed during operation. The 3 × 4-ft. double doors were also carefully lined with tarpaper and asphalt to make the entire chamber gastight and impervious to the corrosive action of chlorine. A wood frame covered with asphalt holds five square trays, on each of which a ¼-in. layer of carefully slaked lime is placed. The chlorine gas enters at the top of the absorption chamber and reacts with the slaked lime to form bleaching powder. The chlorine gas, being heavier than the air, passes from the top of the chamber to the bottom along a tortuous course obtained by arranging the shelves in a zigzag manner. A gas outlet valve is located at the top of the chamber in order to allow the initial chlorine gas to displace the lighter air without diffusion or development of pressure. When the gas fills the chamber, the typical chlorine odor can be detected at the outlet valve. It is then closed, and the gas generation is allowed to continue until the process is completed. Normally it should take twelve hours' contact to produce 30 lb. of bleaching powder, containing 35–39 per cent available chlorine.

The bleaching-powder plant was found to operate fairly satisfactorily despite several difficulties. The dilute product of the sulfuric acid plant is less desirable than a concentrated acid. In addition, the locally produced slaked lime is of inferior quality with a high percentage of impurities, particularly silica.

FIG. 2. Absorption Chamber

The production of chlorine gas by the chemical method, except in localities where raw materials are cheap, is an uneconomical process, and, in most areas, a small electrolysis unit would be more practical for the purpose. This method depends, of course, on the availability of an electric power plant or portable generator.

Addition to Standardization Procedure

In the A.W.W.A. Membership Directory, last published in December 1948, there appears, beginning on page 246, the "American Water Works Association Standardization Procedure." At its 1950 annual meeting, the Board of Directors gave consideration to the addition of certain text to the Procedure which would outline clearly the method of appointing technical committees. The material which follows is to be inserted as a new general section. The procedural statement as a whole also requires further modification to take into account the establishment of the Committee on Water Works Administration, which has a status parallel to that of the Committee on Water Works Practice.

4. Technical Committees

4.1. Organization

Establishment of subcommittees intended to function under the jurisdiction of the Committee on Water Works Practice or the Committee on Water Works Administration shall, in all instances, be subject to prior approval by the Board of Directors.

4.2. Membership

4.2.1. Membership on such committees may be held only by individual members of A.W.W.A., official representatives of Corporate Members or Municipal Service Subscribers, or persons designated to act on such committees as representatives of Associate Members.

4.2.2. When the nature of a committee activity is such as would be benefited by contact with a nonmember of recognized professional or technical standing, such a person may be added to the committee as an Adviser, but shall not have voting power.

4.2.3. When a committee is established for the purpose of developing standards for water works construction or operating materials or equipment, the membership of the committee shall include consumers, representatives of producers of the material or equipment, and independent interests, defined as follows:

Consumers—those using the material or equipment under consideration who are neither directly nor indirectly related to the production, promotion or marketing thereof.

Producers—those who are directly or indirectly associated with the production, promotion, marketing or servicing of the commodity.

Independent Interests—Educators, consulting engineers or others, including federal, state or local personnel having substantial interest in water resources or water supply operations.

4.2.4. The majority represented in the membership of technical committees shall be consumers and/or independent interests. Care shall be taken to provide sufficient representation of producers to insure adequate, objective information concerning the technical problems and economics of production of the commodity, as well as to assure the development of a standards document which is equitable.

4.3. Appointments and Removals

4.3.1. Appointments to and removals from such committees shall be made by the Chairman of the Committee on Water Works Practice or the Chairman of the Committee on Water Works Administration, with the advice and consent of the chairman of the subcommittee under consideration.

4.3.2. Whenever the appointment of producers' representatives would be facilitated thereby, the advice of those Associate Member firms engaged in the production of materials related to such subcommittee activity should be obtained to guide in the selection of one or more persons as official representatives of the producer group.

4.3.3. Membership on a technical committee may be terminated by the Chairman of the Committee on Water Works Practice or the Chairman of the Committee on Water Works Administration because of inactivity of the person removed or whenever the progress of the committee would be expedited by such change. Such changes in committee personnel shall be reported to the Board at one of its stated meetings.

4.3.4. If the balance within a committee would be modified by the change of employment of any member, this may be the basis for dropping such person from the committee.

4.3.5. Membership on all technical committees shall ordinarily be for a period of one year (from the date of one annual meeting of the Board of Directors to the next) but may be extended by specific action of the Board from year to year until the project assigned to the committee has been completed.

Report of the Audit of Association Funds

For the Year Ending December 31, 1949

To the Members of the American Water Works Association:

The By-Laws require that the Secretary shall have an annual audit made of the books of the Association.

The records for 1949 have been examined by the staff of Louis D. Blum & Co. The complete record of that examination follows.

Reference may be made to past audits which appeared in the JOURNAL as follows: pp. 520–25, March 1938; pp. 570–74, March 1939; pp. 516–20, March 1940; pp. 774–78, April 1941; pp. 426–30, March 1942; pp. 338–42, March 1943; pp. 359–63, March 1944; pp. 317–21, March 1945; pp. 386–90, March 1946; pp. 273–78, March 1947; pp. 345–50, March 1948; and pp. 257–61, March 1949.

Respectfully submitted,

HARRY E. JORDAN
Secretary

January 31, 1950

TO THE AMERICAN WATER WORKS ASSOCIATION:

We have examined the balance sheet of the American Water Works Association as of December 31, 1949, and the related statements of income and surplus for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet as of December 31, 1949, and the related statements of income and surplus present fairly the financial position of the American Water Works Association at that date and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

(Signed)

LOUIS D. BLUM & CO.
Certified Public Accountants

EXHIBIT A—Balance Sheet

December 31, 1949

Assets

Cash in Banks and on Hand		$43,191.63*
Accounts Receivable:		
Advertising	$3,525.51	
Reprints	100.03	
Sundry specifications	389.19	
Other	364.80	4,379.53
Membership Dues		411.66
Accrued Interest on Bonds		509.53
Inventories:		
Paper stock	2,275.29	
Type metal	1,127.19	
Cumulative Index (238 copies)	285.60	
Quest for Pure Water—Baker	2,010.58	
Survival and Retirement Book	1,452.10	
Advance costs—Manual of Water Quality and Treatment	750.90	
Sundry specifications	735.14	
Back issues—Journals, Vol. 1–41, inclusive (35,756 copies)	—†	
Back issues—Proceedings, 1881–1913, inclusive (262 copies)	—†	8,636.80
Office Equipment (less depreciation)		5,956.07
Investments at Cost (Schedule 1)		119,238.29
Deferred Expenses:		
1950 Convention	471.83	
1950 Membership Directory	299.10	770.93
Deposit—Airlines		425.00
Total Assets		$183,519.44

Liabilities and Surplus

Accounts Payable	$ 111.86
Membership Dues—Advance Payments	28,985.24
Unearned Subscriptions to Journal	2,828.40
Payable to American Water Works Association Pension System	40,000.00‡
Reserve for Award Fund (McCord)	53.02
Surplus, per Exhibit C	111,540.92
Total Liabilities and Surplus	$183,519.44

* Canadian funds in the Bank of Montreal as at December 31, 1949, amounted to $2,785.77, which, if converted into American currency at that date, would have resulted in a loss of approximately $289.02. Had this loss been recorded, the cash in banks and the surplus would have been decreased accordingly.

† Back issues of Journals and Proceedings are inventoried but no money values are assigned to them for balance sheet purposes inasmuch as the entire costs were charged off during the year of publication.

‡ Secured by assignment of the income of U. S. Savings Bonds, Series G, and maturity redemption value of such bonds in the amount of $40,000.

EXHIBIT A, Schedule 1—Investments

December 31, 1949

Description	Interest Rate %	Principal Amount	Cost	Quoted Market or Redemption Value Dec. 31, 1949
Foreign Securities (see notes):				
Province of British Columbia	4¼	$ 1,000.00	$ 1,000.00	$ 1,025.00*
Province of Ontario	4	1,000.00	732.50	1,142.50*
Canadian Victory Bonds	3	6,000.00	5,647.75	5,415.00†
Canadian Victory Bonds	3	2,000.00	2,000.00	1,790.00†
Hydro Electric Power Commission of Ontario	2¾	5,000.00	5,075.00	4,200.00†
United States Securities:				
City of Los Angeles	3½	2,000.00	2,241.11	2,340.00
U.S. Savings Bonds:				
Series D	2.9	10,000.00	7,500.00	10,000.00‡
Series G	2½	10,000.00	10,000.00	9,670.00‖
Series G	2½	10,000.00	10,000.00	9,490.00‖
Series G	2½	20,000.00	20,000.00	19,020.00‖
Series G	2½	2,000.00	2,000.00	1,922.00‡
Series G	2½	5,000.00	5,000.00	4,790.00‡
Series G	2½	2,000.00	2,000.00	1,898.00‡
Series G	2½	10,000.00	10,000.00	9,470.00‡
Series G	2½	3,000.00	3,000.00	2,841.00‡
Series G	2½	2,000.00	2,000.00	1,902.00‡
Series G	2½	5,000.00	5,000.00	4,780.00‡
Series G	2½	2,000.00	2,000.00	1,912.00‡
Series G	2½	7,500.00	7,500.00	7,335.00‡
U.S. Treasury Savings Notes, Series D	1.4§	5,000.00	5,000.00	5,039.00‡
U.S. Certificates of Indebtedness, Series H	1⅛	9,000.00	9,002.93	9,001.44
Excess of redemption value of U.S. Savings Bonds, Series D, and Savings Notes, Series D, over issue price			2,539.00	
			$119,238.29	$114,982.94

* These securities are payable in United States funds.
† These securities are payable in Canadian funds. Market value represents value in New York in United States funds.
‡ These amounts represent redemption values at close of year 1949.
§ Yield, if held to maturity.
‖ Redemption value and income from these securities assigned to American Water Works Association Pension System.

EXHIBIT B—Statement of Income and Expenses

For the Year Ended December 31, 1949

Operating Income:

Annual dues	$78,608.53	
Advertising	57,099.59	
Subscriptions to Journal	5,437.05	
Convention registration fees	14,262.50	
Convention—other events	4,020.01	
Water and Sewage Works Manufacturers' Association	7,500.00	
Interest on investments	2,288.02	
John M. Goodell prize	75.00	
Miscellaneous interest income	6.46	
Total Operating Income (carried forward)		$169,297.16

TOTAL OPERATING INCOME (brought forward)		$169,297.16	
Publication Income:			
Manual of Water Works Accounting	553.98		
Reprints	2,654.01		
Cumulative Index	54.00		
Membership Certificates	98.00		
Proceedings and Journals	1,032.98		
Quest for Pure Water—Baker	2,160.03		
Water Works Retirement	389.40		
Sundry specifications	5,411.79		
One-half of profit from sales of Standard Methods for the Examination of Water and Sewage	4,957.24		
TOTAL PUBLICATION INCOME		17,311.43	
TOTAL INCOME (carried forward)			$186,608.59
Operating Expenses:			
Directors' and Executive Committee Meetings:			
Travel expense	$ 5,083.63		
Stenographic expense	264.60		
Executive Committee meetings	1,046.50	6,394.73	
Administrative Expenses:			
Rent	5,070.00		
Office supplies and services	9,567.99		
Membership promotion	1,297.18		
Pension—Secretary Emeritus	2,500.00		
Contribution to pension system	3,232.10		
Legal and accounting expenses	2,827.57		
Other	260.32	24,755.16	
Administrative Salaries		50,444.56	
Committee Expense		875.16	
Division and Section Expenses:			
Section—membership allotment	13,738.69		
Section—official travel	4,079.64		
Section—general expense	825.57	18,643.90	
Journal:			
Printing	31,077.35		
Production	2,932.99		
Paper	9,111.42		
Abstractors	184.07	43,305.83	
Convention:			
General	5,309.47		
Entertainment	9,703.12	15,012.59	
Membership Dues in Other Associations		530.00	
John M. Goodell Prize		75.00	
Depreciation of Office Equipment		842.61	
Miscellaneous Expenses		250.87	
TOTAL OPERATING EXPENSES (carried forward)		$161,130.41	

TOTAL INCOME (brought forward)			$186,608.59
TOTAL OPERATING EXPENSES (brought forward)		$161,130.41	
Cost of Publications Sold:			
Manual of Water Works Accounting	$ 262.63		
Reprints	2,274.27		
Cumulative Index	21.60		
Membership Certificates	70.96		
Proceedings and Journals	265.35		
Quest for Pure Water—Baker	2,255.35		
Water Works Retirement	247.18		
Sundry specifications	5,336.82	10,734.16	
Public Relations and Research—Compensation of Water Works Personnel		4,669.40	
TOTAL EXPENSES			176,533.97
Net Income for the Year (transferred to Exhibit C)			$ 10,074.62

EXHIBIT C—SURPLUS FOR THE YEAR ENDED DECEMBER 31, 1949

Balance, January 1, 1949	$151,466.30
Add: Net income for the year, per Exhibit B	10,074.62
	161,540.92
Deduct: Initial contribution to American Water Works Association Pension System	50,000.00
Balance, December 31, 1949, per Exhibit A	$111,540.92

American Water Works Association Pension System

BALANCE SHEET—DECEMBER 31, 1949

Assets

Cash in bank		$ 4,815.94
Accrued bond interest		83.34
Investments:		
U.S. Savings Bonds, Series G (at cost)		10,000.00*
Due from Association		40,000.00†
TOTAL ASSETS		$54,899.28

Liabilities and Reserve

Liability for refund of employees' contributions plus earned interest		$ 1,010.03
Reserve for future benefits:		
Initial contribution by Association	$50,000.00	
Addition for 1949	3,889.25	53,889.25
TOTAL LIABILITIES AND RESERVE		$54,899.28

* Redemption value $9,880.00 at December 31, 1949.
† Secured by assignment of the income of U. S. Savings Bonds, Series G, and maturity redemption value of such bonds in the amount of $40,000.

RECEIPTS AND DISBURSEMENTS FOR 1949

Receipts:		
Association contribution for 1949	$3,232.10	
Employees contributions for 1949	1,010.03*	
Interest on bonds	1,250.00†	
TOTAL RECEIPTS		$5,492.13
Disbursements:		
Legal expenses	$ 550.00	
Office expenses	33.32	
Interest credited to employees' accounts (not actually paid)	9.53	
TOTAL DISBURSEMENTS		592.85
Excess of receipts over disbursements		$4,899.28
Disposition of excess:		
Credited to liability for refund of employees contributions plus earned interest		$1,010.03
Credited to reserve for future benefits		3,889.25
		$4,899.28

* Includes $9.53 representing earned interest, not actually received.
† Includes $83.34 earned but not received.

Membership Statement—1949

	Active	Corporate	Municipal Service Subscribers	Associate	Honorary	Junior	Affiliate	Total
Total members, Jan. 1, 1949...	5944	671		297	30	33	55	7030
Change in membership grade...	9	−85	85		3	−8	−4	
	5953	586	85	297	33	25	51	7030
Gains:								
New in 1949........	932	99	10	19		20	3	1083
Reinstated in 1949........	67	5		1			2	75
	6952	690	95	317	33	45	56	8188
Losses:								
Resignations and deaths.....	169	12		10	1	1	3	196
Dropped for nonpayment....	299	11	1	5		4	3	323
Total members, Dec. 31, 1949..	6484	667	94	302	32	40	50	7669
Total members, Jan. 1, 1949...	5944	671		297	30	33	55	7030
Net Gain in 1949........	540	−4	94	5	2	7	−5	639

Comparative Statement—Gains and Losses—20-Year Period

Year	New	Reinstated	Resignations and Deaths	Suspended for Nonpayment of Dues	Gain or Loss	Total Members at End of Year
1930	501	39	122	134	+285	2831
1931	203	22	123	216	−114	2717
1932	117	22	169	297	−327	2390
1933	168	56	159	234	−169	2221
1934	271	66	86	122	+129	2350
1935	565	42	85	190	+332	2682
1936	311	53	104	218	+ 42	2724
1937	515	86	122	139	+340	3064
1938	520	59	144	140	+295	3359
1939	578	64	112	179	+351	3710
1940	514	58	113	212	+247	3957
1941	480	92	116	236	+220	4177
1942	570	59	132	233	+264	4441
1943	769	88	130	198	+529	4970
1944	734	92	140	171	+515	5485
1945	543	56	111	235	+253	5738
1946	816	79	168	324	+403	6141
1947	933	74	143	349	+515	6656
1948	847	81	207	347	+374	7030
1949	1083	75	196	323	+639	7669

Report of the Committee on Water Works Practice

For the Year Ending December 31, 1949

A report of the activities of the Committee on Water Works Practice for the year ending Dec. 31, 1949, submitted to the A.W.W.A. Board of Directors Jan. 16, 1950, by Louis R. Howson, Chairman.

THIS report covers, for the calendar year 1949, the technical committee activities of the American Water Works Assn. conducted under the guidance of the Committee on Water Works Practice.

1. *Watershed Protection and Maintenance.* Subcommittee Chairman, Earnest Boyce. The newly organized Water Resources Division is concerning itself programwise with activities which have been assigned to this subcommittee. It appears desirable to develop, at the time of the 1950 Conference, a conference between the officers and planning group of the Water Resources Division and the chairman and subchairman of this particular committee, in order to coordinate the committee activities with the current programs of the Water Resources Division.

2. *Deep Wells and Deep Well Pumps.* Subcommittee Chairman, J. C. Harding. The chairman conducted a survey among the members of his committee during 1949 to ascertain what, if any, modifications needed to be made in the current specification document. The consensus of the replies received by the chairman is that, individually, the members of the committee have had no adverse comments filed with them concerning the character of the A.W.W.A. specifications and that no modifications of the text are presently indicated.

In view of the increasing interest in the protection of the public against the dangers of abandoned wells which have not been properly plugged, it appears desirable to request the committee to set up a recommended procedure for blocking off abandoned well holes. From the standpoint of water resources, the danger in the abandoned well hole is the pollution of one water-bearing stratum from another having less desirable characteristics. From the standpoint of the public, the danger to the individual who may fall into abandoned, large-diameter well holes makes it highly important that the industry recognize its responsibility for eliminating this hazard. [*See* p. 304 for Board action.]

3. *Steel Plate Pipe.* Subcommittee Chairman, W. W. Hurlbut; Vice-Chairman, H. A. Price. This is one of the most active committees under Water Works Practice jurisdiction. The status of various documents of the committee is as follows:

Standard Specifications for Riveted Steel Pipe—7A.1–1940, approved and published in 1940, are relatively unused. Consideration has been given to the withdrawal of this specification, but the committee is at present unwilling that the step be taken.

Tentative Specifications for Lock-Bar Pipe—7A.2–T, approved as Tentative and published in 1940, have not been advanced to Standard status. They are called for only on occasions when purchasers wish to have an entire file of this steel pipe series. The Secretary has recommended that the specifications be withdrawn. Vice-Chairman Price agrees and is clearing the matter with the committee.

Standard Specifications for Electric Fusion Welded Steel Pipe of Sizes 30 in. and Over—7A.3–1940 have been revised and reprinted upon numerous occasions. The latest revision was approved by the Board of Directors in October 1949 and the latest printing was made in December 1949. [Revisions published in March 1950 JOURNAL, p. 315.]

Standard Specifications for Steel Water Pipe of Sizes up to But Not Including 30 in.—7A.4–1949, were approved and first published in 1940. The document has been frequently revised. The latest revision was approved by the Board in October 1949. The latest (tenth) printing was issued in 1949. [Revisions published in March 1950 JOURNAL, p. 315.]

Standard Specifications for Coal-Tar Enamel Protective Coatings for Steel Water Pipe consist of two documents, one relating to pipe up to 30 in. (7A.5–1940) and the other relating to pipe over 30 in. (7A.6–1940). These were first published in 1940. Two revisions of the text have been made, the latest in October 1949. The eleventh printing of the text was released in November 1949. [Revisions published in March 1950 JOURNAL, p. 316.]

Standard Specifications for Cement-Mortar Protective Coating for Steel Water Pipe of Sizes 30 in. and Over—7A.7–1941 were first published in 1940. No revisions in the text have been made during the life of the document. The sixth printing was released in November 1949. The committee, however, has in circulation the draft of a revised document, concerning which there is substantial disagreement. This specification is of considerable importance. It is of great interest to the water works industry that the discussions concerning the revision be expedited and the revised document made available without any unnecessary delay.

Tentative Standard Specifications for Field Welding of Steel Water Pipe Joints—7A.8–T were first approved in 1946. Revisions were approved in October 1949. The sixth printing of the text was issued in November 1949. [Revisions published in March 1950 JOURNAL, p. 316.]

4. *Reinforced Concrete Pipe.* Subcommittee Chairman, E. W. Whitlock. The Tentative Standard Specifications for Reinforced Concrete Water Pipe—Steel Cylinder Type, Prestressed—7B.2–T were published in the December 1949 issue of the JOURNAL.

5. *Cast-Iron Pipe.* Subcommittee Mechanical Standards Chairman, J. P. Schwada. Subcommittee Disinfection Procedures Chairman, B. A. Poole. The Tentative Standard Specifications for Installation of Cast-Iron Mains—7D.1–T, prepared by the Mechanical Standards Subcommittee, were published in the December 1949 issue of the JOURNAL. A very substantial amount of discussion of this document was carried on following the 1949 Conference. The members of the Board of Directors, as well as the related committees, were advised as of November 23, 1949, that the Executive Committee of the Board had agreed that no

information had been presented to it which would justify modification of the specifications as approved by the Board of Directors in June 1949.

6. *Valves.* Subcommittee Chairman, F. M. Randlett. The comments filed by the committee members with the chairman, and the suggestions for changes in the document, were filed by the chairman with the Secretary of the Association early in 1949. After a considerable expenditure of time, the Secretary has developed a completely rearranged and edited text of the Specifications for Gate Valves which are presently in production for circulation among the members of the Valve Committee, the producers of water works distribution valves, the Committee on Water Works Practice and so forth. It is hoped that the comments which are received after the circulation of this document will be of such minor nature that it will be possible to expedite the development of a final text and submittal of the document to the Board for approval.

7. *Sluice Gates.* Subcommittee Chairman, T. J. Skinker. The committee is presently inactive.

8. *Fire Hydrants.* Subcommittee Chairman, R. W. Esty. The chairman of the committee turned over to the Secretary early in 1949 a series of comments concerning revision of the specifications, together with suggestions for changes in certain paragraphs. This document as a whole needs complete reorganization along the lines adopted for the valve specifications. This is an editorial task which will be undertaken by the Secretary at the earliest opportunity.

9. *Meters.* Subcommittee Chairman, S. F. Newkirk Jr. Five documents have been developed under the jurisdiction of this committee as presently organized. They are:

Standard Specifications for Cold-Water Meters—Displacement Type—7M.1–1946 (first published in 1941)

Standard Specifications for Cold-Water Meters—Current Type—7M.2–1947 (first published in 1946)

Standard Specifications for Cold-Water Meters—Compound Type—7M.3–1947 (first published in 1946)

Standard Specifications for Cold-Water Meters—Fire Service Type—7M.4–1949 (first published in 1947)

Tentative Standard Specifications for Cold-Water Meters—Current Type—Propeller Driven—7M.5–T (first published in 1949).

The chairman of the committee considers that the need of the water works field for standardization documents for meters has been satisfied by the documents which his committee has developed. He recommends that the Specifications for Cold Water Meters—Current Type—Propeller Driven, be advanced to Standard status not later than the 1950 Conference. He further recommends that the committee, as presently organized, be discharged and that an adviser in the field of water works meters be appointed to handle matters of interpretation of existing specifications.

10. *Service Line Materials.* Subcommittee Chairman, W. A. Peirce. There was published in the August 1948 Journal a collection of specifications for service line materials issued by other organizations.

The committee chairman contemplates an outline of procedure for the installation of water service lines, but the subject has not reached the definitive stage.

11. *Standards for Threads for Underground Service Line Fittings.* Subcommittee Chairman, W. W. Brush. No adverse comments concerning the content of the Standard Specifications for Threads for Underground Service Line Fittings—7T.1–1948 have been filed with the Association since they were advanced to Standard status in September 1948. The chairman of the committee recommends that it be discharged and that an adviser representing the consumer group and one representing the producer group be appointed to consider any questions which may be raised upon the subject and to recommend, when and if indicated, the appointment of a new committee on the matter. [*See* p. 304 for Board action.]

12. *Asbestos-Cement Pipe.* Subcommittee Chairman, Samuel M. Clarke. Following authority granted by the Board of Directors, the Subcommittee on Specifications for Asbestos-Cement Pipe for Underground Water Service has been appointed. For the record, the personnel of the committee is as follows:

S. M. Clarke, *Chm.*	W. R. Gelston
E. H. Aldrich	R. W. Horn
T. C. Bristol	W. D. Hurst
P. D. Cook	R. I. MacDonald
J. W. Cunningham	W. D. Masterson
J. R. Forsythe	B. S. Thomas

Manufacturers' Representatives

R. L. Barbehenn	A. J. Maahs
C. R. Hutchcroft	A. B. Spaulding

The first tentative draft of the specifications was sent to the committee members as of December 14, 1949. A discussion of the document is planned for the 1950 Conference. [*See* p. 304 for Board action.]

13. *Standard Specifications for Cast-Iron Pipe and Special Castings.* In 1908 the A.W.W.A., jointly with the N.E.W.W.A., promulgated specifications for cast-iron pit-cast water pipe and special castings. When, in 1939, the American Standards Assn. document on pit-cast pipe, A21.2, was issued, it was assumed that the 1908 document would be of no further value. This has been found not to be true. It is necessary to reissue the section of the 1908 document relating to special castings. Tables of revised weights of special castings have been filed with the Secretary by the Cast-Iron Pipe Research Assn. When the complete set of revised tables has been received, the entire lot will be put into type and referred to the A.W.W.A. representatives and N.E.W.W.A. representatives on A.S.A. Committee A21, asking their approval of the revised weight tables as an A.W.W.A.-N.E.W.W.A. specification. The reason for this procedure is that these castings continue to be widely used within the water works industry. Errors which existed in the 1908 weight tables are being corrected, and the revised document will continue to be of use to the industry for many years to come. [*See* p. 304 for Board action.]

It is also intended to reprint, as a separate section, the portion of the 1908 specifications which related to pit-cast water pipe. This class of material continues to be purchased by a large number of water works properties and, both as a currently used document and as a historical record, this section needs to be separated from the specifications for special castings and made available for the use of the producers and consumers of cast-iron pipe purchased under the old Class *A, B, C* designations. This separate document will also be referred to the appropriate A.W.W.A.

and N.E.W.W.A. committees for acceptance by the two associations. [*See* p. 304 for Board action.]

14. *Deep Well Vertical-Turbine Pumps* (*A.S.A. B58*). This committee, authorized on July 1, 1949, will operate under American Standards Assn. procedure. The scope of the committee's work is defined as: "Formulation of American Standards for Deep Well Vertical-Turbine Pumps, including materials, dimensions, production ratings and methods of testing of vertical-turbine pumping equipment designed to lift water, at normal temperature, from underground sources. The equipment to be standardized consists of three elements: [1] the head and driver assembly; [2] the column-shaft assembly or conductor system; and [3] the pump unit proper."

Marvin H. Owen, Mech. Engr., Operating Div., Los Angeles Dept. of Water and Power, and Perry H. Brown, Chief Engr., Johnston Pump Co., Los Angeles, have been designated cochairmen. [The final list of appointments, dated January 20, 1950, comprises eight men of the "consumer" class, seven of the "producer" class and nine of the "general-interest" class, a total of 24 members. Representatives of all interested organizations are included.] The cochairmen of the committee in the meantime are developing a preliminary outline of the specifications for consideration by the entire committee.

At the same time that the request was filed for the establishment of the Committee on Deep Well Vertical-Turbine Pumps, a request was filed by A.S.M.E. for authority to operate, under A.S.A. procedure, a committee on cone valves. This committee has been authorized by A.S.A. with the code number, B61. Its organization is presently being set up by A.S.M.E., and the A.W.W.A. will be represented on the committee.

Water Purification Division Subcommittees

15. *Specifications and Tests for Water Purification Chemicals.* Editorial Coordinator, J. E. Kerslake. The committee draft of the Tentative Standard Specifications for Sodium Chloride—5W1.01–T was submitted with letter ballot to the officers of the Water Purification Division, the Committee on Water Works Practice and the Board of Directors as of June 13. The draft was approved by the required majority of all groups. On the same date the draft was submitted to a selected list of "critics" in the field. All comments received (from the critics as well as the Association approval groups) were submitted to W. W. Aultman, who had been appointed "referee." The referee's revised draft was circulated among the officers of the Water Purification Division and received their unanimous approval. It was then turned over to the Editor of the JOURNAL for publication in the March 1950 issue [p. 317].

The committee drafts of the following specifications have been submitted with letter ballot to, and have been approved by, the required majority of the officers of the Water Purification Division, the Committee on Water Works Practice and the Board of Directors. Each specification has also been submitted to a selected list of "critics" in the field. All comments received have been referred to, and are still undergoing study by, the selected referee for the respective specification:

Tentative Standard Specifications for	Date of Submittal (1949)	Referee
Sulfate of alumina	April 29	G. R. Spalding
Ferrous sulfate	April 29	A. V. Graf
Powdered activated carbon	June 9	Oscar Gullans
Sodium fluoride	June 24	C. A. Black
Soda ash	June 29	W. I. Van Arnum
Caustic soda	July 1	M. D. Baker
Ammonium sulfate	July 1	N. A. Thomas

The three sets of specifications noted below were sent to the officers of the Water Purification Division for preliminary approval and then directly to the referees. When the referee's report is received, the completed document will be mimeographed and sent to the Committee on Water Works Practice and the Board of Directors for approval before publication:

Tentative Standard Specifications for	Date of Submittal (1949)	Referee
Quicklime and hydrated lime	Oct. 13	Samuel Shenker
Trisodium phosphate	Oct. 17	R. C. Bardwell
Bauxite	Nov. 14	E. S. Hopkins

The following materials are also included in the specification series: ferric sulfate, ferric chloride and copper sulfate. Editorial Coordinator Kerslake has not completed work on these documents but expects to do so during the early part of 1950.

16. *Biological and Chemical Problems of Water Distribution Systems.* Subcommittee Chairman, J. C. Vaughn. The committee is collecting distribution system survey data in Middle-West cities. The committee also proposes to address itself to specific problems which may be brought to the attention of the chairman by the individual members.

17. *Specifications for and Methods of Testing Zeolites.* Subcommittee Chairman, D. E. Davis. A revised manual has been published under the title, "Tentative Manual of Cation Exchanger Test Procedures—5Z-T," in the May 1949 issue of the JOURNAL. The committee has completed its work and the Water Purification Division proposes to inactivate it and to appoint W. W. Aultman as adviser upon the subject matter until further organized activity is required. [*See* p. 304 for Board action.]

18. *Practical Loading Capacities of Water Treatment Plants.* Subcommittee Chairman, H. O. Hartung. The committee is presently collecting experience data from operators of upflow type basins, which it hopes to have compiled for the 1950 Conference.

19. *Water-Conditioning Methods to Inhibit Corrosion.* Subcommittee Chairman, K. W. Brown. The chairman has reported his inability to make progress satisfactory to him and recommends that the committee be reorganized purely on a survey basis, section by section, to report upon the progress being made in the reduction of the corrosive tendencies of public water supplies in the different parts of the United States. This redirection of activity on the part of the committee will necessarily have to be considered and cleared by the Water Purification Division.

20. *Specifications for Filtering Materials.* Subcommittee Chairman, Richard Hazen. The chairman has reviewed the committee document, Tentative Standard Specifications for Filtering Material—5C-T, as published in the March 1949 JOURNAL. No changes in the document are under consideration. It is recommended that the docu-

ment be advanced to Standard status. [*See* p. 304 for Board action.]

21. *Open-Air Reservoirs.* Subcommittee Chairman, N. J. Howard. The third progress report of this committee was presented to the Water Purification Division at one of its sessions during the 1949 Conference. Copies of this document have been sent to 40 engineers in various parts of the country with the request that they study it and address their comments to the chairman of the committee. The consolidated opinions of these engineers will be taken into account by the chairman in presenting his fourth and final draft of the committee report at the 1950 Conference.

22. *Disposal of Wastes From Water Purification and Softening Plants.* Subcommittee Chairman, W. W. Aultman. Reports concerning the disposal of wastes from lime and lime-soda plants and cation-exchange softeners were presented at the 1949 Conference and published in the September 1949 issue of the JOURNAL.

The committee still has scheduled a report concerning the disposal of simple coagulation wastes from routine filtration plants. These wastes occur in a large number of installations, but have not presented a problem of disposal related to the disposal of wastes from softening plants. A definite date for the presentation of the report on simple purification wastes has not yet been set.

23. *Standard Methods for the Analysis of Water and Sewage.* Subcommittee Chairman, R. L. Derby. This committee, which cooperates with committees of the American Public Health Assn. and the Federation of Sewage Works Assns., under the jurisdiction of the Joint Editorial Board, is engaged in a review of 30 different categories of analytical procedure included in the current edition of *Standard Methods for the Examination of Water and Sewage.*

Since it is important that the Joint Editorial Board initiate definitive action looking toward the tenth edition of *Standard Methods* sometime during the year 1950, the A.W.W.A. committee recognizes its responsibility for recommendations to the Editorial Board at the earliest possible moment.

Beginning with its next edition, *Standard Methods for the Examination of Water and Sewage* (ninth edition, 1946) will be sponsored by the A.W.W.A., A.P.H.A. and F.S.W.A. as a cooperative venture. (Since 1925 it has been jointly sponsored by the A.W.W.A. and A.P.H.A.) H. A. Faber, A.W.W.A. representative on the Joint Editorial Board, is its chairman. Mac Harvey McCrady represents the A.P.H.A., and W. D. Hatfield, the F.S.W.A. on the board.

24. *Standardization Committee on High-Rate Filtration.* The Water Purification Division has filed a request for authority to organize a "Standardization Committee on High-Rate Filtration." Action upon the request has been deferred until after the 1950 Conference, at which time an open discussion of the problems related to high-rate filtration is scheduled.

Committees Operating Under A.S.A. Procedure

25. *A21—Cast-Iron Pipe.* A considerable volume of material under the jurisdiction of this committee has been filed with the A.W.W.A. during the year 1949, since the A.W.W.A. acts as publication sponsor for the cast-iron pipe standards. The documents, as

they reach this office, are edited by the Journal staff and cleared with the committee chairman.

The following is the status of the various documents:

Manual for the Computation of Strength and Thickness of Cast-Iron Pipe—A21.1. Revisions to Part I of the manual are now being made by the chairman in order to bring that portion of the book into accord with the new section which is being added to the earlier text. The new section is intended to cover the special conditions relating to the production of centrifugally cast pipe.

Specifications for Pit Cast Pipe for Water or Other Liquids—A21.2. Revisions of this text have been advanced to page proof form.

Specifications for Cement-Mortar Lining for Cast-Iron Pipe—A21.4. The A21 committee is at work on a revision of this text, but nothing has been filed with this office for publication.

Specifications for Cast-Iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids—A21.6; and Specifications for Cast-Iron Pipe Centrifugally Cast in Sand-lined Molds, for Water or Other Liquids—A21.8. Galley proofs of these specifications were sent in October 1949 to all members of A21 Technical Subcommittee 1. When these are returned, they will go to the whole committee for approval.

Specifications for Short-Body Cast-Iron Fittings, 3 in. to 12 in., for 250-psi. Water Pressure Plus Water Hammer —A21.10. This document is now advanced to the preprint stage. When received, the preprints will be distributed to the sponsor organizations for their approval. All approval routine within the A21 committee is complete.

It should be understood that documents developed under A.S.A. procedure must be approved by the sponsor, or by the group of sponsors, if there is more than one. The A21 documents have four sponsors—A.W.W.A., A.G.A., N.E.W.W.A. and A.S.T.M. Each document, after it has been set in type and approved by the A21 committee, has to be converted into preprint form and sent to each sponsor body for approval. The routines within the various organizations differ, but at least six months must be allowed after the time that preprints are distributed to sponsors, for the text to be reviewed by the special committees and the approval of the sponsors to be received.

26. *A35—Manhole Frames and Covers.* F. A. Marston represents the A.W.W.A. on this committee. The document which was produced by the committee is not under consideration for revision. The sponsors of this document were the A.S.C.E. and the "Telephone Group." When it was approved in 1941, neither sponsor was willing to publish it. Since it was a text of great importance to the water works industry, it was printed in the Journal (July 1942) and reprinted as a separate document for distribution. It appears desirable to initiate a review of the text, to see whether the committee should be reactivated.

27. *A40—American Standard Plumbing Code.* In August 1928 the A.S.A. appointed a Sectional Committee on Minimum Requirements for Plumbing and Standardization of Plumbing Equipment. Originally the committee was sponsored by the American Society of Mechanical Engineers and the American Society of Sanitary Engineers. The major task of the committee—that is, the development of

a standard plumbing code—made little progress until the sponsorship of the project was changed, adding the American Public Health Assn. to the sponsor group and removing the American Society of Sanitary Engineers.

T. I. Coe, American Institute of Architects, Washington, D.C., was then made general chairman of the committee. The A.W.W.A. representatives then appointed were F. M. Dawson and W. J. Scott. The editor of the final document was A. H. Morgan, Director, Div. of Building Management, Dept. of Public Works, New York City. A very substantial amount of credit for the completion of the task is due to him. The Plumbing Code was accepted as an American Standard in February 1949. The text was published by the American Society of Mechanical Engineers and the committee inactivated. [*See* p. 304 for Board action.]

An interpretation committee has been appointed with A. H. Morgan as chairman. One of the members of the committee is F. M. Dawson. The interpretation committee is charged with the task of answering specific inquiries on the code and interpreting any ambiguous or poorly defined parts of the code. The committee is also asked to act as a continuing review committee, looking forward to revisions of the code when it appears proper to recommend a sufficient amount of change in the text to justify its revision.

There has also been appointed a Coordinating Committee for Uniform Plumbing Codes. F. M. Dawson is chairman of this committee and the executive secretary is Vincent Manas of the U.S. Dept. of Commerce. This coordinating committee was established for the purpose of reconciling a series of federal agency standards with the A.S.A. document.

To F. M. Dawson, for his patient service on the A40 committee; to W. J. Scott; to T. I. Coe; to Warren Cowles; to Sol Pincus; and to other members of the original A40 committee, the Association is greatly indebted. There is probably no standardization activity which has involved a greater variety of factors. Complications were increased by the excessive number of organizations represented on the committee.

28. *B2—Pipe Threads.* For a number of years W. W. Brush was the A.W.W.A. representative on this committee. When the committee was being reorganized under the sponsorship of A.S.M.E. in the summer of 1949, Brush suggested that it would be an auspicious time to relieve him of this assignment. Accordingly, J. G. Bradbury, Chief Engr., Hays Manufacturing Co., who had actively cooperated in the development of the A.W.W.A. standards for threads for underground service fittings, was invited, and has accepted the assignment. [*See* p. 304 for Board action.]

29. *B16—Pipe Flanges and Fittings.* O. B. Carlisle, A.W.W.A. representative on this committee, reports that the committee has in progress a proposed standard on cast-brass soldered-joint fittings and a standard on gasket dimensions.

During the year the committee completed the following three standards: Brass or Bronze Screwed Fittings, 250 lb.—B16.17–1949; Ferrous Plugs, Bushings and Locknuts With Pipe Threads—B16.14–1949; and Steel Pipe Flanges and Flanged Fittings, Supplement No. 1—B16e6–1949.

30. *B31—Code for Pressure Piping.* The A.W.W.A. representative is Edward Hubbard. No work was completed by the committee during the year, but eleven subcommittees are engaged in major revision of the code, section by section.

31. *B36—Standardization of Dimensions and Materials of Wrought-Iron and Wrought-Steel Pipe and Tubing.* The A.W.W.A. representative is Edward Hubbard. During 1949 A.S.A. Standard B36.19–1949 for stainless steel pipe was issued. Revision of Wrought-Iron and Wrought-Steel Pipe —B36.10 is nearing completion.

32. *B61—Specifications for Rotary Cone Valves.* This committee was authorized by A.S.A. in midyear 1949. The A.S.M.E. is the sponsor. Richard Hemborg, a member of the A.W.W.A., is the chairman, but the committee is not fully organized. The A.W.W.A. will be properly represented.

33. *Z10—Letter Symbols and Abbreviations for Science and Engineering.* The A.W.W.A. representative is W. E. Howland. Standard Symbols for Gas Turbines and for Aeronautical Science were issued during the year. A series of other documents is in preparation.

34. *Z23—Specifications for Sieves for Testing Purposes.* The A.W.W.A. representative is G. M. Fair. The committee has been inactive since a document was issued under its jurisdiction in 1939. As Fair wishes to be relieved of this assignment, it appears desirable to appoint as his successor Richard Hazen, who is chairman of the A.W.W.A. Committee on Filtering Materials. [*See* p. 304 for Board action.]

35. *Z32—Graphical Symbols for Use on Drawings.* The A.W.W.A. representative is W. V. Weir. During 1949 three documents were completed: American Standard for Graphical Symbols for Pipe Fittings, Valves, and Piping; American Standard for Graphical Symbols for Welding; and American Standard for Graphical Symbols for Heating, Ventilating and Air Conditioning.

The committee has in process the following two documents: Graphical Symbols for Heat Power Apparatus and Abbreviations for Use on Drawings (revision of Z32.13–1946).

36. *Z59—Committee on Permeability.* This committee was established in 1949 to carry on certain work which had been initiated by the American Geophysical Union. W. F. Guyton, U.S. Geological Survey, is A.W.W.A. representative. The committee has not yet begun action.

A.W.W.A. Representation on Committees of Other Organizations

37. *American Welding Society—Committee on Inspection of Welded Structures.* R. C. Kennedy is the A.W.W.A. representative. No changes are presently contemplated in the report previously released by the committee.

38. *American Geophysical Union—Committee on Intersociety Relations.* S. B. Morris is the A.W.W.A. representative. The committee is inactive.

39. *National Fire Protection Association—Electrical Code Committee.* F. E. Dolson is the A.W.W.A. representative. The 1949 edition of the National Electrical Code was issued by N.F.P.A. during the year. Certain changes were made in the section of the code relating to grounding.

40. *American Society of Civil Engineers—Committee on Rates and Rate Structures in Water and Sewage Works.* D. L. Erickson is the A.W.

W.A. representative. The committee was established in 1948 with Samuel Greeley as chairman. The committee is required to cooperate with the Municipal Law Section of the American Bar Assn. This committee is quite active in its consideration of the fundamentals of rate making for both water and sewage works.

Joint Committees With Other Organizations

41. *Glossary of Water and Sewage Works Terms.* The year 1949 brought to a close an enterprise which had been initiated by the A.W.W.A. and reorganized in 1936 as a joint enterprise of the A.W.W.A., A.P.H.A., and A.S. C.E. Later the consideration of sewage works terms was included, and the Federation of Sewage Works Assns. was added to the joint sponsor group.

The project as a whole has now been brought to a successful completion. As must be expected in a dictionary type publication, the opinions of quite a few individuals concerning the meanings of words do not agree with the ideas of the editorial staff. The American Society of Civil Engineers has undertaken the task of collating suggestions for improvements as they may be made, against the date when a future edition of the glossary will be published. The A.W.W.A. has disposed of practically its entire share of the number of volumes printed. [*See* p. 304 for Board action.]

42. *Interassociation Correlating Committee on Cathodic Protection.* The A.W.W.A. representatives are F. E. Dolson and A. R. Davis. Three bulletins have been released by the Committee and published in the JOURNAL—two during 1949, one in 1948. Bulletin 1, entitled "Cathodic Protection of Buried Metallic Structures," was published in the May 1948 issue. The bulletins published in the September 1949 JOURNAL were entitled "Cathodic Protection Notification Procedures" and "Joint Cathodic Protection Systems." The final bulletin in the series is to be entitled "Technical Practices Bulletin." It will be published in the JOURNAL when it has been released by the committee.

43. *A.W.W.A.-A.S.M.E. Committee on Standard Dimensions of Flanges for Steel Water Pipe.* Engineers of the American Rolling Mill Co. have made a valuable contribution to the work of this committee, having conducted a series of experimental stress analyses, which have been taken into consideration by the committee. H. O. Hill, chairman of the joint committee, is hopeful that the project may be brought to a conclusion during 1950.

44. *Steel Standpipes and Elevated Tanks—Joint Committee of A.W. W.A., N.E.W.W.A. and A.W.S.* This committee was previously operating under the chairmanship of L. R. Howson. H. O. Hill was made chairman of the committee during 1949. Revisions of the Standard Specifications for Elevated Steel Water Tanks, Standpipes and Reservoirs (A.W.W.A. 7H.1–1948) were accepted by the sponsors during 1948 and published in the JOURNAL for April 1949. The Tentative Recommended Practice for Inspecting, Repairing and Repainting Elevated Steel Water Storage Tanks (A.W.W.A. 7H.2–T) was revised during 1948 and again, to a minor degree, in 1949. The complete revision was published in the October 1948 JOURNAL, and a supplementary revision was published in the November 1949 JOURNAL. The complete document is now available in reprint form.

At the present time the committee is considering the reconciliation of specification details for paint as they appear in the two documents. It appears desirable to eliminate a little divergence of expression concerning the specifications for paint which now exists.

Board Action

Acting on the recommendations of the chairman of the Committee on Water Works Practice, the Board:

1. Instructed the Committee on Deep Wells and Deep Well Pumps to formulate a procedural standard for sealing abandoned wells.

2. Changed the name of the Committee on Steel Plate Pipe to "Committee on Steel Pipe."

3. Discharged the Committee on Recommended Standards for Threads for Underground Service Line Fittings and appointed W. W. Brush and J. G. Bradbury as advisers.

4. Restricted asbestos-cement pipe specifications to "Pipe for Water Distribution Underground Installations."

5. Approved the plan: [1] to revise the tables of weights and the specifications for special castings in the "Standard Specifications for Cast-Iron Special Castings—7C.1–1908"; and [2] to publish portions of the 1908 document relating to pit-cast pipe as a separate document for information only. The material is to be referred for approval to the A.W.W.A. representatives on A.S.A. Committee A21. The N.E.W.W.A. is to be advised and cooperative action and approval developed.

6. Discharged the Committee on Specifications for and Methods of Testing Zeolites, and appointed W. W. Aultman as adviser.

7. Advanced the Tentative Standard Specifications for Filtering Material—5C–T to Standard. The new designation will be "5C–1950."

8. Relieved F. M. Dawson and W. J. Scott, with thanks, from their assignment to A.S.A. Committee A40, which is now inactivated.

9. Expressed its appreciation to W. W. Brush for his service on A.S.A. Committee B2 and approved the appointment of J. G. Bradbury to succeed him on the committee.

10. Relieved G. M. Fair, with thanks, from his assignment to A.S.A. Committee Z23 and appointed Richard Hazen in his place.

11. Relieved, with thanks, the A.W.W.A. representatives on the Joint Committee on a Glossary of Water and Sewage Works Terms. This committee is now inactivated.

12. Confirmed the appointment of H. O. Hill to the Committee on Water Works Practice.

Report of the Committee on Water Works Administration

For the Year Ending December 31, 1949

A report of the activities of the Committee on Water Works Administration for the year ending Dec. 31, 1949, submitted to the A.W.W.A. Board of Directors Jan. 16, 1950, by W. R. LaDue, Chairman.

THE Committee on Water Works Administration came into being at the Atlantic City Conference of 1948. The background of its organization was fully set forth in the 1948 committee report (March 1949 JOURNAL).

The present organization provides for seventeen subcommittees grouped in four classifications, as outlined on pages 263–67 of the 1948 Membership Directory. The Committee on Water Works Administration consists of the committee chairman, the general chairmen of the four groups and the chairmen of the various active subcommittees. Other members of the various subcommittees are not members of the Committee on Water Works Administration. The present roster of committee personnel is as follows:

W. R. LADUE, *Chairman*

F. C. AMSBARY	M. P. HATCHER
C. J. ALFKE	A. P. KURANZ
L. E. AYRES	D. L. MAFFITT
M. B. CUNNINGHAM	C. E. MOORE
J. C. DETWEILER	L. A. SMITH
E. F. DUGGER	L. N. THOMPSON
L. S. FINCH	W. V. WEIR

Changes in the committee during the year were the addition of L. E. Ayres, chairman of Subcommittee A4.B—Water Rate Schedules, and of J. C. Detweiler, chairman of Subcommittee A3.A—Taxation and Fund Diversion; and the substitution of C. E. Moore for L. S. Vance as chairman of Subcommittee A1.A—Constitutional and Statutory Aspects of Municipal Water Works Organizations. Table 1 outlines the committee's operations.

It is the aim of the committee to proceed deliberately and, upon obvious member demand, to establish a long-time policy of continuing activities; and to maintain close cooperation with the Committee on Water Works Practice.

At the 1949 Conference, thirteen topics stemming from the committee's activities, either directly or indirectly, were presented at the various sessions:

Committee A1.A—progress report; paper, "Water Department Operation Under City Manager Administration," by G. E. Arnold (August 1949 JOURNAL).

Committee A1.B—panel discussion, "Use of Radio by Water Departments" (October 1949 JOURNAL).

Committee A1.C—progress report.

Committee A2.B—panel discussion, "Insurance Protection for Municipal Water Departments" (October 1949 JOURNAL).

Committee A2.C—progress report.

Committee A2.D—progress report.

Committee A3.A—panel discussion, "Diversion of Water Department Reserve Funds" (November 1949 JOURNAL); paper, "Wisconsin Policies on Water Works Funds," by Timothy Brown (August 1949 JOURNAL).

Committee A3.D—progress report.

Committee A4.A—progress report; paper, "Making Annual Reports Interesting," by E. B. Mayer (January 1950 JOURNAL).

TABLE 1

Water Works Administration Committee Operational Outline

Subcommittee		Chairman
	Committee A1—Organization and Administrative Policy W. V. Weir, *General Chairman*	
A1.A	Constitutional and Statutory Aspects of Municipal Water Works Organizations	C. E. Moore
A1.B	Radio and Mobile Communication Facilities for Water Works	M. B. Cunningham
A1.C	Water Use in Air Conditioning	F. C. Amsbary
A1.D	Water Use in Fire Prevention and Protection	C. J. Alfke
A1.E	Construction, Equipment and Material Contracts	(inactive)
	Committee A2—Public and Worker Relationships D. L. Maffitt, *General Chairman*	
A2.A	Public Relations	E. F. Dugger
A2.B	Management Relations	(inactive)
A2.C	Compensation of Water Works Personnel	L. A. Smith
A2.D	Pension and Retirement Plans	D. L. Maffitt
	Committee A3—Financing E. F. Dugger, *General Chairman*	
A3.A	Taxation and Fund Diversion	J. C. Detweiler
A3.B	Valuation and Depreciation	(inactive)
A3.C	Cost Trends	(inactive)
A3.D	Water Main Extension Policy	L. S. Finch
	Committee A4—Accounting and Statistics A. P. Kuranz, *General Chairman*	
A4.A	Water Department Reports	M. P. Hatcher
A4.B	Water Rate Schedules	L. E. Ayres
A4.C	Joint Administration of Water and Sewer Facilities	L. N. Thompson
A4.D	Water Consumption	(inactive)

Committee A4.B—panel discussion, "Rethinking Water Rate Structures" (November 1949 Journal).

The conference also saw the activation of subcommittees A3.A—Taxation and Fund Diversion, J. C. Detweiler, Chairman, and A4.B—Water Rate Schedules, L. E. Ayres, Chairman.

Work of Subcommittees

The year saw much work carried forward by the various subcommittees:

A1.A—Constitutional and Statutory Aspects of Municipal Water Works Organizations. Plans have been made for a state-by-state compilation of data concerning the legislative background of municipal water works and water district organizations. The subcommittee chairman has outlined the work for 1950 in terms of the following objectives:

1. Secure a copy of the general state act empowering a magisterial subdivision of the state to pass ordinances to enable it to purchase, construct, enlarge, operate and maintain a municipal water supply system.

2. Secure a copy of a typical local ordinance passed by virtue of such general law for each type of magisterial subdivision.

3. If no general statutes exist, secure copies of specific state acts granting the right to a magisterial subdivision to form the water supply organization under the following three heads:

a. Water district (serving more

than one magisterial subdivision of the state).

b. Water department, as a part of the local government and controlled entirely by it.

c. Water department, under a nonpolitical group known as commissioners, trustees and so forth.

4. Obtain copies of typical local ordinances under which such water systems have been created by virtue of such special state government legislation.

A1.B—Radio and Mobile Communication Facilities. Through the individual activities of the committee members, as well as through contacts of the committee with the water works industry representatives in the Regional Radio Allocation Groups, it appears practical for this subcommittee to appraise the value and problems of the use of radio facilities by water works and to prepare an annual report upon the subject for modification.

A1.C—Water Use in Air Conditioning. This committee has filed a preliminary report as committee recommendations, published in the August 1949 issue of the JOURNAL. The members of the subcommittee also participated in a water supply session carried on during the American Society of Refrigerating Engineers' convention in Chicago in December 1949.

The chairman of the subcommittee reports the following immediate objectives of his group:

1. Development of a demand meter. It was the consensus of this small group that the water utility, as well as the customer, would be better off if a demand meter could be developed and a clause incorporated in the rules and regulations stating that, at the discretion of the water utility, a demand meter may be set on any commercial or industrial account. In this way, no one could claim discrimination. Moreover, there are, in every system, uses other than air conditioning and refrigeration in which a demand meter would promote the conservation of water.

2. Development of a model guide for regulating those customers who do not wish to use the demand meter.

3. The earliest possible completion of the querying of all regulatory bodies and a sample of municipalities, to obtain their advice on, and, if possible, their approval of, the use of demand meters—if developed—and of rules and regulations restricting the use of water.

A1.D—Water Use in Fire Prevention and Protection. This subcommittee is not fully organized and has no activity under way.

A2.A—Public Relations. The subcommittee supports the idea of continuing the distribution of the specially prepared public relations guidance material. This attitude is evidenced by statements received by the chairman of the group from the various members of the subcommittee. These comments are summarized as follows:

1. "The material is excellent and I believe the program should be continued. I am favorable to the issuance of bulletins from time to time rather than a manual."

2. "Suggest all issued material be reprinted in an issue of the JOURNAL. In this form, more easily filed and available. If this done, have sufficient copies printed to give one to each new member of A.W.W.A."

3. "Strongly favor using the title 'Public Relations at Work' and then 'Personified by Willing Water,' using slightly larger type for 'Public Relations at Work.' Would like to see program augmented, four issues per year. Stress payment of water bills through subcollection agencies. Consider travel collection vehicles such as

those used by Consolidated Edison Co. Have exhibit at 1950 Convention, properly located, staffed and mounted."

4. "Continue program on quarterly issue basis. Coordinate program in some way with state and national antipollution programs and forest conservation work."

A2.C—Compensation of Water Works Personnel. The subcommittee chairman reviewed with the staff members of the Public Administration Clearing House organization in Chicago the possibility of that agency's conducting a salary and classification survey in a limited group of cities (with various populations) where water works facilities were publicly owned and operated. The proposal from the P.A.C.H. was reviewed by the members of the subcommittee, and it was decided not to follow that procedure.

At the present time the committee chairman is outlining a survey which could be conducted under more directly controlled auspices and with more consideration of the water works viewpoint. An item is being requested for inclusion in the 1950 budget to cover the expenses of this special operation.

A2.D—Pension and Retirement Funds. This committee has in preparation a review, as of 1950, of legislation on and operating backgrounds of pension and retirement systems in the various states. This will supplement the prior valuable studies made by the subcommittee and published in the JOURNAL.

A3.A—Taxation and Fund Diversion. This subcommittee is not yet fully organized and no activity has been started. The need for action is becoming more apparent.

A3.D—Water Main Extension Policy. A report of this subcommittee's activities was published in the August 1949 JOURNAL. The committee continues its work in the expectation of filing further information and recommendations with the membership as a whole. It must be remembered that, in an area of action as universal as water main extension, the policies which have developed in the thousands of water utilities over the country during the years that water works have been operated are bound to be diverse. At the same time these policies are bound to be rather fixed in the habit and custom of the individual communities. This condition means that the subcommittee's guidance action must be continued and reemphasized for a substantial period of time before a reasonably consistent pattern of action develops within the industry.

A4.A—Water Department Reports. The subcommittee chairman has drawn up a tentative draft of a final report for his committee. The chairman hopes to present it for discussion during the 1950 Conference. He recommends that thereafter the subject be discussed to the fullest extent possible at the meetings of the various sections.

A4.B—Water Rates. This subcommittee, under the excellent leadership of its chairman, conducted a very stimulating discussion of the subject at the 1949 Conference, published in the November 1949 JOURNAL. The chairman and the entire personnel of the subcommittee are carrying on their discussion with extraordinary diligence.

Liaison with the A.S.C.E.-sponsored Committee on Water and Sewer Rates is established in the person of D. L. Erickson, a member of the subcommittee. The activities of each group are being brought to the attention of the other. At the present time there is no specific conflict in the areas under exploration by the different committees, although in such matters there is al-

ways the possibility that conflicts of activity and purpose may develop.

Special consideration is being given at the present time to: [1] the basis of earnings of a publicly owned water utility; [2] development of a clear understanding of the percentage of the total cost of the water works property which is attributable to public fire protection; [3] the handling of depreciation reserves of publicly owned properties; and [4] the payment of taxes by municipally owned water works as an element in the rate base.

The subject matter of this activity is of universal interest to the entire industry. It is fully evident that the water works industry as a whole will receive a substantial contribution to its advancement through this work.

A4.C—Joint Administration of Water and Sewer Facilities. No special activity is under way.

The topics to be presented at the 1950 Conference are being discussed among the committee members and with the other groups in the Association interested in the Conference sessions, particularly the Publication Committee. It is possible that the following subcommittees will be represented in the program: A1.A, preliminary report; A1.C, A4.A and A4.B, progress report; A2.C; and A2.E, panel discussion looking toward the formation of a new subcommittee.

During the meeting of the committee at the 1950 Conference, the activation of the following subcommittees will be carefully considered:

A1.D—Water Use in Fire Prevention and Protection. Although this subcommittee is considered an "active" committee under C. J. Alfke as adviser, no members have been assigned to it. With the activation of Committee A4.B—Water Rate Schedules, Committee A1.D should be activated to cooperate with the former in the study of overall rate schedules for the utility. Fire protection rates will eventually enter the picture.

A2.B—Management Relations. It is believed that this phase of the worker relationship is a natural outgrowth of and corollary to our continuing program on public and personnel relations. The committee should therefore be activated to cooperate with and carry the work of Committee A2.A to the "local level" and into the various organizations of the water utility.

A2.E—Personnel Safety. This is a new subcommittee, intended to cover the field of personnel contacts involving the question of personnel safety and kindred personnel physical working conditions.

A4.D—Water Consumption. The continued interest in and discussion of water conservation makes it essential that a study of water consumption be undertaken by those most interested in water conservation—water works administrators. This is to insure that the water works men are adequately represented and their problems properly presented at any discussion of conservation and allocation of water.

The activation of these subcommittees leaves but three contemplated subcommittees inactive: A1.E—Construction, Equipment and Material Contracts; A3.B—Valuation and Depreciation; and A3.C—Cost Trends.

Another question to be brought before the committee is the changing of the title of Committee A1.C—Water Use in Air Conditioning. The subcommittee has raised the question as to whether the present title is discriminatory. The thought is to broaden the name to cover all phases of cooling. For the moment, the title "Water Use in Cooling and Air Conditioning" is suggested.

Report of the Editor

For the Year Ending December 31, 1949

A report on the publishing activities of the Association submitted to the A.W.W.A. Board of Directors on Jan. 16, 1950, by Eric F. Johnson, Editor.

As a result of an increase of approximately 25 per cent in printing costs applied in November 1948, the JOURNAL was in 1949 subjected to a rigid economy program aimed at avoiding half those increased costs through production economies, while absorbing the other half. During the year this economy program was successfully applied without materially reducing the services offered to members, and record gains in circulation and advertising more than offset the balance absorbed. During 1949, also, the *Glossary—Water and Sewage Control Engineering* was finally issued and a second printing of *The Quest for Pure Water* completed and made available for sale. Work on the second edition of the *Manual of Water Quality and Treatment* progressed to the point where more than half the text is now either in type or being typeset. And, finally, by expanding promotional activities and by maintaining all titles in stock continuously, sales of both books and specifications were increased to unprecedented levels.

A detailed report of the publication projects of the Association follows:

1. The Journal

a. *Contents.* In line with the abovementioned economy program, the overall size of the JOURNAL was reduced from 2,464 total pages in 1948 to 2,336 in 1949, the saving in space being accomplished almost entirely by rearrangement rather than omission of technical contents. Although this curtailment, together with an increase in advertising space, also involved a 42-page reduction in the number of text pages—from 1,218 in 1948 to 1,176 in 1949—economies in editing and makeup compensated for that reduction. Thus, the total of articles published actually increased from 139 in 1948 to 141 in 1949. Included in the list of articles published were 25 Annual Conference papers, 71 Section Meeting papers, 18 contributions from the field and 27 A.W.W.A. reports and official documents.

With its transfer to the advertising pages, the abstracts section was also reduced somewhat in size by limiting coverage to foreign publications and others difficult for readers to obtain. Meanwhile, to assist the reader in checking other American publications, a list of significant current articles pertinent to the field was printed at the end of each abstracts section. By this means, total abstracts pages for 1949 were held to 85, as against 148 in 1948.

Gains in advertising involved an increase in the number of pages devoted to the news and advertising section, making the 1949 total 1,152, compared with 1,088 in 1948 and 1,026 in 1947. Since this total is directly dependent upon the number of right-hand page advertisements sold, the only satisfac-

tory means of enlisting that section in an economy program is by transferring to it material from other portions of the JOURNAL. This, of course, is what was done in relocating the abstracts section.

Because any further increases in the size of the advertising section will encroach upon the text, and because increased income is expected next year as a result of the imposition of an advertising rate increase and further gains in circulation, it is now proposed to enlarge the size of the 1950 JOURNAL by 160 pages. At a printing and production cost of only $2,500, this increase will permit the publication of more technical material to balance the gains in advertising pages.

b. *Cost.* Despite the economy program, such factors as circulation growth—which boosted the average printing from 8,314 copies in 1948 to 9,036 in 1949—and the absorption of half the increase in the cost of printing forced total JOURNAL printing and production costs up to $43,272.19, compared with $39,392.84 in 1948. The effect of the economy measures, however, is reflected in the fact that total costs per copy were only 0.3¢ higher—39.9¢ in 1949, 39.6¢ in 1948—while the cost per 1,000 pages printed rose from $1.89 in 1948 to $2.01 in 1949.

With no increase in the size of the JOURNAL itself, circulation growth in 1950 would force total costs up to $47,000. Since it will be impossible to maintain current services if more space must be devoted to the advertising section, and since a substantial increase in income from advertising is expected during 1950, it is felt that the above-noted increase in the size of the JOURNAL is economically justified. With printing costs apparently stabilizing, and with a reduction in paper costs to the mid-1947 level, an increase of 160 pages to regain the ground lost during the past year will cost approximately $2,500, setting the 1950 budget at $49,500.

c. *Income.* Income represented by the proportion of dues payments applicable to JOURNAL subscriptions again increased by an amount substantially more than that required to offset the costs of increased circulation. And nonmember subscription income exceeded by 11 per cent the amount budgeted. Meanwhile advertising income continued to rise, too, showing a gain of 4 per cent over the record 1948 total, with 749 pages sold, as against 729 in 1948.

With the imposition of a 15 per cent advertising rate increase as of January 1, 1950, advertising income during the coming year is expected to increase in approximately the same proportion. Actually, definite commitments for a total of 614 pages had been received by the end of 1949, an advance figure that would indicate little if any loss attributable to the increase in rates. Adjustments of existing contracts will, however, hold the actual yield somewhat below the full 15 per cent for the first year.

To date no advertiser objection has been raised to the increase, primarily because the JOURNAL has been able to demonstrate a 25.6 per cent rise in net paid circulation since the end of 1946, when the last previous rate increase was made. And, of course, even with the increase, JOURNAL advertising rates will remain the lowest in its field, although it offers the largest circulation.

2. Membership Directory

Plans for the 1950 edition of the biennial Membership Directory are already being worked out on the basis

of issuing the volume as a supplement to the September 1950 JOURNAL.

Since it was possible this time to send out advertising announcements well in advance, a substantial increase in the amount of space sold is anticipated, and definite commitments received to date seem to bear out this expectation. Further increment will also result from the fact that rates for the 1950 Directory advertising will be based upon a higher JOURNAL advertising rate and will thus, page for page, yield approximately 15 per cent more income.

Expenses of the 1950 edition will, of course, also be higher than those of the 1948 Directory. Increases in printing and production costs and an increase from 9,500 to 11,000 in the number of copies required have indicated that a minimum budget of $8,000 will be necessary.

More specifically, in an effort to improve the format of the Directory as a reference volume, plans are being made to lessen its bulk by reducing the type size of the major lists included and to improve its wearing qualities by providing a more substantial cover. At least one additional feature—a directory of consulting engineers—is also planned.

3. Specifications

In 1949 five sets of specifications and two recommended procedures were approved and published in the JOURNAL. These included specifications for filtering material, elevated steel tanks, propeller-driven meters, prestressed concrete pipe and installation of cast-iron pipe, and procedures for tank maintenance and fluoridation. All are now available in reprint form.

During the year sales of specifications totaled a record $3,163.79, some 70 per cent above the 1948 figure. Although part of this increase in receipts was a result of the average 25 per cent increase in specifications prices applied in January 1949, the real gain in sales was an impressive 36 per cent. Some portion of this gain was attributable to the heightened activity of Association committees in issuing new documents and some to the increased membership, but a great deal, too, must be credited to the new system of inventory control, which kept the bulk of the documents available for sale at all times.

In regard to costs, it may be pointed out that the price increase in January was made to cover both past and anticipated cost increases. And, although the actual cost increase imposed by the printer was larger than anticipated, equaling the full 25 per cent price increase, a decline in paper costs and the placing of more economical large print orders made it possible to absorb its effects with no further boost in prices to members.

Also introduced during 1949 was a specially imprinted loose-leaf binder for A.W.W.A. specifications and other standards. Of the trial lot of 100 copies ordered, all but 30 had been sold by the end of the year.

4. Journal Indexes

The sale of 18 copies of the 1881–1939 Index during 1949, compared with 11 copies in 1948, left a balance of 238 copies in stock. Sale of 22 copies of the 1940–1944 Supplement left its stock at 244.

Preliminary work on a 1945–1949 Supplement has been directed toward producing a more useful consolidation of annual indexes. With this work under way, questions have arisen concerning the content and distribution which would make it most valuable to members. Three possibilities are be-

ing explored: [1] a five-year supplement, paper-bound, to be distributed free to members and subscribers as a supplement to the JOURNAL; [2] a five-year supplement, paper-bound, to be distributed by sale only; [3] a ten-year supplement for the years 1940–1949, cloth-bound, to be distributed by sale only. Preliminary estimates indicate that the free-distribution supplement would cost approximately $1,200 for 10,000 copies, and that followup sales of extra copies at $1.00 each would return approximately $300 in income over the next few years. If the five-year supplement were produced for sale only, a printing of 1,000 copies would cost approximately $650 and return $1,000 in income over the next few years at a sale price of $1.00 per copy. Finally, if a ten-year supplement in permanent binding were issued, a printing of 2,000 copies would cost approximately $2,600 and return $4,000 in income at a price of $2.00 per copy. Further investigation of these possibilities, taking into consideration also such items as the availability of staff time during a Directory year, is being made with the idea of presenting a report, with recommendations, first to the Publication Committee and then to the Board.

5. Standard Methods

During 1949 approximately 3,000 copies of the ninth edition of *Standard Methods for the Examination of Water and Sewage* were sold, increasing total distribution of this edition to approximately 12,500 and leaving a balance of approximately 4,500 in stock. The 1949 sales, which were actually about 400 greater than the 1948 total, are a remarkable commentary on the continuing market for this volume.

It is hoped that work on the tenth edition, under Chairman Harry A. Faber of the Joint Editorial Board, will be completed in 1951, with publication in 1952. During the year Ray L. Derby took over leadership of the A.W.W.A. committee responsible for the water analysis sections of the book.

6. Accounting Manual

The effect of its inclusion in two promotional pieces was obvious in the sales of the *Manual of Water Works Accounting*. During 1949, 11 years after its publication, 160 copies were sold, compared with 51, 54 and 21 copies in the three preceding years.

7. Survival and Retirement Book

During 1949, its third year in print, 125 copies of *Survival and Retirement Experience With Water Works Facilities* were sold, leaving a balance of 446 bound and 1,000 unbound copies in stock. The increase in sales from 69 copies in 1948 also reflects the Association's 1949 promotional activity.

8. The Quest for Pure Water

In 1949 approximately 500 copies of *The Quest for Pure Water* were sold, exhausting the first printing of 1,000. A second printing of 1,500 copies, authorized by the Board in January 1949, became available for distribution in November. Only 500 copies of this second printing have been bound, the balance being held in flat sheets for future binding as required.

It is interesting to note that, although direct-mailing pieces have boosted the demand for the book, the original review distribution has apparently kept a steady flow of sales between these peaks, a large number of copies being ordered through bookstores and wholesale bookdealers. It should be pointed out, too, that, if this second printing can be sold over the next few years, the Association will be able to recover

the full amount of its investment in the project, including such items as overhead and staff salaries attributable to it.

9. Glossary

In May and June 1949 the two editions—paper- and cloth-bound—of the *Glossary—Water and Sewage Control Engineering* were at last issued. Final negotiations with the American Society of Civil Engineers, as publication agents, and the other cosponsors—the American Public Health Assn. and the Federation of Sewage Works Assns.—indicated the advisability of increasing the A.W.W.A. sales commitment to at least 1,000 copies in order to gain a quantity price advantage. With the approval of the Executive Committee, 500 paper-bound copies, to sell at $1.00 each, and 500 cloth-bound copies, to sell at $2.00 each, were ordered. So many of these copies were sold on the original promotional mailing that no further sales effort has been expended. As of the end of the year, 497 copies of the paper-bound and 465 of the cloth-bound edition had been sold. Continuing sales as a result of inclusion on the list of A.W.W.A. publications will undoubtedly dispose of the remaining copies during 1950. Orders received after the A.W.W.A. stock is exhausted will be referred to the other participating societies.

No definite date for revision of the *Glossary* has been established, but comments and criticisms have been solicited and are being deposited in a file maintained by the A.S.C.E. against that eventuality.

10. Manual of Water Quality and Treatment

During the late summer of 1949 arrangements were finally concluded with Lancaster Press for the printing of the second edition of the *Manual of Water Quality and Treatment*. This agreement followed the purchase of some new composing equipment, without which Lancaster Press had been unable to take on the extra work, and followed, too, the unsatisfactory results of contacts with other printers equipped to handle the job.

With the agreement made and the format worked out on the basis of Lancaster's equipment, manuscript preparation was undertaken immediately. To date the first nine chapters, representing well over half the text, have been styled, checked and forwarded to the printer for typesetting, and the first six chapters, representing slightly more than a third of the text, are now in galley proof. Top priority is being given to this job with the idea of having the volume issued sometime in the summer of 1950, so that it will be available as a textbook for fall courses. With approximately 750 orders now in hand, it is expected that a first printing of 5,000 copies will be necessary.

11. Depreciation Study

Only lack of staff time is now holding up work on Henry Earle Riggs' *The Troublesome Problem of Depreciation*, publication of which was approved in July 1947. At the earliest moment after the *Manual of Water Quality and Treatment* has been completed, attention will be given to this project.

Board Action

The Board approved in principle a 160-page increase in the size of the Journal for 1950, to cost approximately $2,500 above the budget required to maintain its 1949 size.

Revision of Steel Pipe Specifications

The following changes, approved by the Association's Board of Directors on October 3, 1949, are to be made in A.W.W.A. Standard Specifications for Electric Fusion Welded Steel Water Pipe (7A.3–1940 and 7A.4–1941–TR); A.W.W.A. Standard Specifications for Coal-Tar Enamel Protective Coatings for Steel Water Pipe (7A.5–1940 and 7A.6–1940); and A.W.W.A. Tentative Standard Specifications for Field Welding of Steel Water Pipe Joints (7A.8–T).

7A.3–1940

In A.W.W.A. "Standard Specifications for Electric Fusion Welded Steel Water Pipe of Sizes 30 Inches and Over—7A.3–1940," make the following changes:

1. Sec. 3–1.2.8. At the end of the paragraph, add the phrase: "not to exceed 1½ times the pressure specified in Sec. 3–1.2.4."

2. Sec. 3–3.11—Rounding up of Pipe Sections. The section is changed to read:

"Sec. 3–3.11—Rounding up of Pipe Sections and Sizing of Pipe Ends. If it is necessary to reshape pipe after it has been welded, it shall be performed by rerolling or by pressure. Reshaping of pipe by excessive hammering or dropping will not be permitted. Sizing of pipe ends to come within specified end tolerances shall be permitted."

3. Sec. 3–4.2—Tolerance for Straightness. The section number is changed to 3–4.3. Likewise, the number of Sec. 3–4.3—Tolerance for Length is changed to 3–4.4. A new Sec. 3–4.2 is added, as follows:

"Sec. 3–4.2—Tolerance for Circumference, Except at Ends. The outside circumference of pipe shall not vary more than 0.5 per cent over or under the size specified, except that the circumference at ends shall be sized if necessary to meet the requirements of Sec. 3–4.1."

4. Sec. 3–5.4.2. The section is changed to read:

"5.4.2. *Bends, Branch Connections and Special Sections:* Bends made in accordance with the requirements of these specifications by certified welding operators from tested pipe shall not be subjected to a hydrostatic test. All bends not fabricated from tested pipe, and branch connections and other special connections shall be subjected to a hydrostatic test pressure specified by the purchaser but not exceeding 1½ times the working water pressure. Sections that cannot be tested in a testing machine may be prepared for testing by welding on heads, or as otherwise approved by the engineer, and after testing the ends shall be reconditioned when necessary."

The note following this section (at the top of Column 2, page 13, of the specifications) is to be deleted.

7A.4–1941–TR

In A.W.W.A. "Tentative Revision of Standard Specifications for Electric Fusion Welded Steel Water Pipe of Sizes up to But Not Including 30 Inches—7A.4–1941–TR," make the following changes:

1. Delete the words "Tentative Revision of" from the title of this specification and change the numerical designation to "7A.4–1949."

2. Sec. 4–1.2.9. At the end of the paragraph, add the phrase: "not to exceed 1½ times the pressure specified in Sec. 4–1.2.8."

3. Sec. 4–3.8—Rounding up of Pipe Sections. The section is changed to read:

"Sec. 4–3.8—Rounding up of Pipe Sections and Sizing of Pipe Ends. If it is necessary to reshape pipe after it has been welded, it shall be performed by rerolling or by pressure. Reshaping of pipe by excessive hammering or dropping

will not be permitted. Sizing of pipe ends to come within specified end tolerances shall be permitted."

4. Sec. 4–4.1.1—Diameter. The section is changed to read: "The outside diameter of pipe shall not vary more than 1 per cent over or under the size specified, based upon circumferential measurement, except that the diameter at ends shall be sized, if necessary, to meet requirements of Sec. 4–4.1.6."

5. Sec. 4–4.2.1—Diameter, Ends. Add a new paragraph at the end of the section, as follows:

"(8) The outside diameter of pipe shall not vary more than 1 per cent over or under the size specified, based upon circumferential measurement, except that the diameter at ends shall be sized, if necessary, to meet the requirements of Sec. 4–4.2.1 (2)."

6. Sec. 4–5.7.3. The section is changed to read:

"5.7.3. *Bends, Branch Connections and Special Sections:* Bends, branch connections and other special sections made in accordance with the requirements of Sec. 4–3.7 by certified welding operators from tested pipe shall not be subjected to a hydrostatic test pressure. All bends, branch connections and other special connections not fabricated from tested pipe shall be subjected to a hydrostatic test pressure specified by the purchaser but not exceeding 1½ times the working water pressure."

The note following this section is to be deleted.

7A.5–1940

In A.W.W.A. "Standard Specifications for Coal-Tar Enamel Protective Coatings for Steel Water Pipe of Sizes 30 Inches and Over—7A.5–1940," the fifth sentence of Sec. 5–3.2—Preparation of Surfaces is changed to read: "All metal surfaces shall be thoroughly cleaned by blasting."

7A.6–1940

In A.W.W.A. "Standard Specifications for Coal-Tar Enamel Protective Coatings for Steel Water Pipe of Sizes up to But Not Including 30 Inches—7A.6–1940," the fifth sentence of Sec. 6–3.2.1—Mechanical Cleaning is changed to read: "All metal surfaces shall be thoroughly cleaned by blasting."

7A.8–T

In A.W.W.A. "Tentative Standard Specifications for Field Welding of Steel Water Pipe Joints—7A.8–T," make the following changes:

1. Sec. 8–5.1.1.1—Reduced-Section Tension Test. The section is changed to read: "The tensile strength shall be not less than 85 per cent of the minimum of the specified tensile range of the base material used."

2. Sec. 8–5.1.2.1—Tension Test. Paragraph (b) of this section is changed to read:

"(b) The tensile strength of single-welded lap joints shall be not less than 75 per cent of the minimum of the specified tensile range of the base material used; and, for double-welded lap joints, 90 per cent of the minimum of the specified tensile range of the base material used. The above values are to be based upon the cross-sectional area of the steel coupon adjacent to the joint."

3. Sec. 8–6.2.1. Following the second sentence of this section, insert the sentence: "Specials, fittings and appurtenances which can be entered or reached into for inside welding shall be double welded."

4. Sec. 8–6.3.1. Following the second sentence of this section, insert the sentence: "Specials, fittings and appurtenances which can be entered or reached into for inside welding shall be double welded."

5. Sec. 8–8.7.3. Insert the words in italics: "Undercutting of the base metal in pipe adjoining the weld is a defect and shall be repaired if it exceeds the amount given in Sec. *8–9.5.5 and* 8–9.5.6.

6. Sec. 8–8.8—Weld Reinforcement. At the end of the second sentence, add the words "of the pipe."

American Water Works Association

Tentative

STANDARD SPECIFICATIONS

for

SODIUM CHLORIDE

These "Tentative Standard Specifications for Sodium Chloride" are based upon the best known experience and are intended for use under normal conditions. They are not designed for use under all conditions and the advisability of use of the material herein specified in any water treatment plant must be subjected to review by the chemist/engineer responsible for operations in the locality concerned.

Approved as Tentative by the Board of Directors of the A.W.W.A. on July 6, 1949

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AMERICAN WATER WORKS ASSOCIATION

Incorporated

500 Fifth Avenue, New York 18, N.Y.

Table of Contents

These "Tentative Standard Specifications for Sodium Chloride" were prepared under the direction of C. K. Calvert (deceased) and J. E. Kerslake of the Water Purification Division, A.W.W.A. The specifications were approved by the Executive Committee of the Water Purification Division and by the Water Works Practice Committee, and received the approval of the Association's Board of Directors on July 6, 1949. The specifications were also submitted for review to producers and consumers of the materials involved, whose comments were then considered by W. W. Aultman, acting as referee. The text as finally edited was approved by the Executive Committee of the Water Purification Division on December 29, 1949.

Tentative Standard Specifications for Sodium Chloride

Part A—Material Specifications

Sec. 1A—Scope

These specifications cover sodium chloride, either evaporated or rock salt, for use in the regeneration of cation-exchange materials for softening municipal and industrial water supplies. The specifications are intended for use in connection with Part B (Sampling, Inspection, Packing and Marking) and Part C (Testing Methods) of this document.

Sec. 2A—Definitions

2A.1. Sodium chloride, more widely known as common salt, is a natural, stable compound having the formula NaCl. When pure, it is a colorless, transparent and crystalline solid, crystallizing in small cubes.

2A.2. Evaporated salt is defined as that formed by the grainer, vacuum pan or solar methods of production.

Sec. 3A—Sampling

Sampling shall be conducted in accordance with Part B (Sampling, Inspection, Packing and Marking) of this document.

Sec. 4A—Methods of Testing

The laboratory examination shall be carried on in accordance with Part C (Testing Methods) of this document.

Sec. 5A—Impurities

The sodium chloride supplied under these specifications shall contain no soluble mineral or organic substances in quantities capable of producing deleterious or injurious effects upon the health of those consuming the water softened through a cation-exchange material which has been properly regenerated with sodium chloride.

Sec. 6A—Physical Requirements

6A.1—*General.* The material shall be homogeneous and in a dry, granular form and shall be free from lint, chips, trash or other foreign matter.

6A.2—*Color.* The salt shall be white to grayish white or grayish pink, brown or brownish white.

6A.3—*Solubility.* The salt shall dissolve rapidly without packing. When tested by the standard float procedure as described in Sec. 8C of this document, it shall not require more than 20 minutes to go into complete solution.

6A.4—*Fineness:*

6A.4.1. The rock salt shall be of such fineness that it shall pass a No. 3 sieve and that 95 per cent of it shall be retained on a No. 70 sieve.

6A.4.2. Evaporated salt shall be of such fineness that at least 85 per cent of it shall be retained on a No. 70 sieve.

6A.4.3. The above sizing shall not apply to salt pressed into small briquets.

6A.4.4. All sieve numbers referred to in these specifications are U.S. Standard Sieve Series numbers, as specified in the Standard Specifications

for Sieves for Testing Purposes (A.S. T.M. Designation E11-39) of the American Society for Testing Materials.

Sec. 7A—Rejection

7A.1. Notice of dissatisfaction with a shipment, based on the specifications, must be in the hands of the consignor within ten days after receipt of the shipment at the point of destination. If the consignor desires a retest, he shall notify the consignee within five days of notice of the complaint. Upon receipt of the request for a retest, the consignee shall forward to the consignor one of the sealed samples. In the event that the results obtained by the consignor on retesting do not agree with the results obtained by the consignee, the other sealed sample shall be forwarded, unopened, for analysis to a laboratory agreed upon by both parties. The results of the referee analysis shall be accepted as final and the cost of the referee analysis shall be paid for by the party whose results show the greatest discrepancy from the referee results.

TABLE 1

Maximum Tolerance Limits

Substance	Tolerance Limit *per cent by weight*	
	Rock Salt	Evapd. Salt
Moisture	2.00	0.20
Dry Basis		
Calcium and magnesium (Ca & Mg)	0.60	0.60
Sulfate (SO_4)	1.50	1.00
Water-insoluble impurities (silica, etc., exclusive of calcium and sulfate)	2.00	0.05
Total impurities	4.00	2.00
Grease, fat or oil	0.00	0.00

7A.2. On the basis of the retest or the referee test, the consignor may remove the material from the premises of the consignee or a price adjustment may be agreed upon by the consignor and consignee.

Sec. 8A—Chemical Specifications

8A.1. The sodium chloride shall contain no constituents which, if released into cation-exchange softened water after regeneration and rinsing, will impair the usefulness of the water for domestic consumption. In addition, Table 1 sets forth the maximum limits of tolerance of certain constituents.

8A.2. The solution formed by dissolving the salt in distilled water shall have a phenolphthalein alkalinity of zero and a hydrogen ion concentration (pH) no higher than 8.0.

Part B—Sampling, Inspection, Packing and Marking

Sec. 1B—Scope

These procedures for the sampling, inspection, rejection, retesting, packing, weighing and marking of sodium chloride are intended for use in connection with Part A (Material Specifications) and Part C (Testing Methods) of this document.

Sec. 2B—Sampling

2B.1. Samples shall be taken at the point of destination.

2B.2. If the material is packaged, 5 per cent of the packages shall be sampled. No sample shall be taken from a broken package.

2B.3. When delivered in bulk, the

sample material shall be selected so that it will represent an average of all parts of the car and shall not contain a disproportionate share of the top or bottom layers. Coarse material taken from cars shall comprise at least ten shovelfuls from different parts of the car, and the total material so taken shall weigh not less than 100 lb. The material shall be mixed and quartered to a sample of about 10 lb. and treated as described in Sec. 2B.6.

2B.4. Finely divided material, whether in bulk or packages, may be sampled by the use of a sampling tube which is at least $\frac{3}{4}$ in. in diameter, taking special precautions to avoid including a disproportionate amount of the material from the top or the bottom.

2B.5. If the sodium chloride is handled by conveyor or elevator, a mechanical sampling arrangement may be used.

2B.6. The gross sample, weighing at least 10 lb., shall be mixed thoroughly and quartered to provide three 1-lb. samples. They shall be sealed in airtight, moistureproof glass containers. Each sample container shall be labeled to identify it and the label shall be signed by the sampler. The laboratory examination of the sample shall be completed within five working days after the receipt of the shipment.

Sec. 3B—Inspection

The inspector shall examine the shipment for evidence of foreign matter (dirt, fibers and the like) which would be detrimental to the use of the salt. Failure to pass this inspection shall constitute a full basis for rejection. A sample of salt shall not be sent to the laboratory for further test if the shipment is thus rejected.

Sec. 4B—Packing and Shipping

4B.1. Sodium chloride may be shipped in bulk or in 100-lb. bags or other commercial packages, unless otherwise required in the specifications.

4B.2. Unless otherwise specified, the subject commodity shall be packaged in substantial containers of the type, size and kind commonly used for the purpose, so constructed as to insure acceptance and safe delivery by common or other carriers at the lowest rate to the point of delivery called for in the contract or purchase order. The container used shall be of sufficient strength to permit coarse crushing of the salt should it become caked during storage.

4B.3. The net weight of packages shall not deviate from the recorded weight by more than $2\frac{1}{2}$ per cent, plus or minus. If exception is taken to the weight of the material received, it shall be based on a certified unit weight of not less than 10 per cent of the packages shipped and selected at random from the entire shipment.

Sec. 5B—Marking

Each shipment of material shall carry with it some means of identification. Each package shall have marked legibly thereon the net weight of the contents, the name of the manufacturer and a brand name, if any. The package may bear also the statement: "Guaranteed by (name of manufacturer) to meet the specifications of the American Water Works Association for sodium chloride."

Part C—Testing Methods

Sec. 1C—Scope

These methods for the examination of sodium chloride are intended for use in connection with Part A (Material Specifications) and Part B (Sampling, Inspection, Packing and Marking) of this document.

Sec. 2C—Sampling

2C.1. Sampling shall be conducted in accordance with Part B (Sampling, Inspection, Packing and Marking) of this document.

2C.2. Undue grinding is to be avoided and samples to be ground shall be handled as expeditiously as possible to prevent undue loss of moisture. Samples to be used for moisture determination shall not be screened. Material passing a No. 80 sieve (U.S. Series) should be kept to a minimum. To gain this end, if the sample as received appears to contain fine particles, the portion of it not used for moisture determination should be screened on a No. 20 sieve (U.S. Series). The material retained on the sieve should then be ground, frequently putting the material on the sieve to avoid overgrinding.

2C.3. The particles of the sample may be reduced by mechanical grinding, or in a mortar by hand, to such size that all of it passes a No. 20 sieve (U.S. Series). After thorough mixing, this sample should be stored in an airtight container and weighed out of it rapidly to avoid change in moisture content.

Sec. 3C—Moisture

3C.1—*Procedure:*

3C.1.1. Weigh accurately about 10 g. of the sample into a tared moisture dish or weighing bottle.

3C.1.2. Place in an oven at a temperature of 103°–110°C. After one hour, remove to a desiccator, cool and weigh. Repeat until constant weight is obtained.

3C.2—*Calculation:*

$$\frac{\text{Loss of weight}}{\text{Weight of sample}} \times 100 = \text{per cent moisture}$$

Sec. 4C—Insoluble Matter

4C.1—*Procedure:*

4C.1.1. Place exactly 50 g. of the sample in a 400-ml. beaker and add 250 ml. of distilled water at room temperature.

4C.1.2. Stir with a glass rod until all the salt is dissolved. Filter through a tared Gooch crucible.

4C.1.3. Rinse the beaker three times with 5–7 ml. of water to bring all the insolubles on the filter. Wash the residue on the filter six times with 5–7 ml. each time, or until the filtrate is free from chloride. If the insolubles contain fine clay particles, these may be drawn through the asbestos mat into the filtrate if washing is resumed after the mat has once been sucked dry. Under these conditions, the washing shall be continuous, with a layer of water maintained over the mat until washing is completed.

4C.1.4. Dry in an oven to constant weight at 103°–110°C.

4C.2—*Calculation:*

$$\frac{\text{Loss of weight} \times 100 \times 100}{\text{Weight of sample} \times (100 - \%\ \text{moisture})} = \text{per cent insoluble matter (dry basis)}$$

Sec. 5C—Calcium

5C.1—*Reagents:*

(a) Hydrochloric acid, 1 : 1

(b) Ammonium hydroxide, 1 : 1

(c) Ammonium oxalate solution (a saturated solution of $(NH_4)_2C_2O_4 \cdot H_2O$ at room temperature)

(d) Methyl red indicator solution

(e) Potassium permanganate solution, 0.1 *N* $KMnO_4$

(f) Sulfuric acid, 1 : 10 by volume

5C.2—*Procedure:*

5C.2.1. Dilute the filtrate from the insoluble matter (4C.1.3) in a volumetric flask to exactly 500 ml. After thorough mixing, take exactly 100 ml. for the determination of calcium. Add a few drops of methyl red solution and 1 : 1 hydrochloric acid, dropwise, until the solution just changes to red. Add 5 ml. of 1 : 1 hydrochloric acid.

5C.2.2. Heat the solution to boiling and add 35 ml. of hot ammonium oxalate solution. Add 1 : 1 ammonium hydroxide solution until the solution changes to yellow and continue boiling until the precipitate becomes granular.

5C.2.3. Reprecipitation is required if the value of calcium exceeds the limit set up in the specifications.

5C.2.4. Allow the precipitate to settle; filter and wash thoroughly with successive small portions of hot distilled water.

5C.2.5. Transfer the paper and precipitate to the beaker in which the precipitation was made, spreading the paper out against the upper portion of the beaker. Wash the precipitate from the paper with a jet of hot water. Fold the paper and leave it adhering to the upper portion of the beaker.

5C.2.6. Add 50 ml. of 1 : 10 sulfuric acid and dilute to a total volume of about 200 ml. with hot distilled water. Heat to 80°–90°C. (Note: To avoid interference with the endpoint during the potassium permanganate titration, the filter paper should not be in contact with the acid solution during heating.)

5C.2.7. Titrate with 0.1 *N* $KMnO_4$ until a pink endpoint is reached. Push the filter paper from the side of the beaker into the solution. The pink color will be discharged. Finish the titration by adding potassium permanganate dropwise, until the pink endpoint is reached again.

5C.2.8. If desired, a Gooch crucible may be used for the filtration instead of paper.

5C.3—*Calculation:*

$$\frac{\text{ml. of } 0.1\ N\ KMnO_4 \times 0.002 \times 100 \times 100}{\text{Weight of sample} \times (100 - \%\ \text{moisture})} = \text{per cent calcium (Ca) (dry basis)}$$

Sec. 6C—Magnesium

6C.1—*Reagents:*

(a) Solution of diammonium hydrogen phosphate, $(NH_4)_2HPO_4$, 10 g. in 100 ml. of distilled water

(b) Concentrated hydrochloric acid

(c) Methyl red indicator

(d) Concentrated ammonium hydroxide

(e) Ammonium hydroxide, 1 : 100

6C.2—*Procedure:*

6C.2.1. To the filtrate from the precipitation of the calcium, add a few drops of methyl red indicator and make just red with hydrochloric acid. Concentrate to about 150 ml. While boiling, add a slight excess of hot diammonium phosphate solution and continue gentle boiling for several minutes.

6C.2.2. Add the concentrated ammonium hydroxide, dropwise, while stirring constantly until the crystalline precipitate begins to form, and then add about 5 ml. more. Continue this stirring for several minutes and allow the liquid to stand at room temperature for 12–48 hours.

6C.2.3. Filter through a tight quantitative (Whatman No. 42) filter paper and wash thoroughly with 1 : 100 ammonium hydroxide.

6C.2.4. Place the filter and precipitate in a crucible, porcelain preferred, and dry thoroughly. Burn off the paper at moderate temperature; ignite at about 1100°C. to constant weight.

6C.3—*Calculation:*

$$\frac{\text{Weight of residue} \times 0.2184 \times 100 \times 100}{\text{Weight of sample} \times (100 - \%\ \text{moisture})} = \text{per cent magnesium (Mg) (dry basis)}$$

Sec. 7C—Sulfate

7C.1—*Reagents:*

(a) Hydrochloric acid, 2 per cent by weight in distilled water

(b) Barium chloride, 10 per cent by weight in distilled water

7C.2—*Procedure:*

7C.2.1. To exactly 100 ml. of the diluted filtrate from the insoluble determination made up as specified in 5C.2.1, add 2 ml. of 2 per cent hydrochloric acid and boil. While boiling, add a slight excess of barium chloride solution with rapid stirring and set aside at room temperature for about eighteen hours. (NOTE: According to recognized authorities one-hour digestion of sulfate on a steam bath gives as good quality precipitate as eighteen hours' standing at room temperature.)

7C.2.2. Filter through a tight quantitative (Whatman No. 42) filter paper and wash with hot distilled water until a 25-ml. portion of the filtrate shows no more than a slight opalescence with silver nitrate.

7C.2.3. Place the filter paper containing the precipitate in a weighed platinum crucible and heat slowly over a low flame to char the filter paper without allowing it to catch on fire. After complete charring, ignite to constant weight over an ordinary burner with the crucible uncovered, cooling between weighings in a desiccator. (NOTE: If the charring of the paper is too rapid, some of the barium sulfate may be reduced to barium sulfide. If so, moisten the precipitate with concentrated sulfuric acid, heat very carefully to drive off the acid and finally ignite.)

7C.3—*Calculation:*

$$\frac{\text{Weight of } BaSO_4 \text{ residue} \times 0.4115 \times 100 \times 100}{\text{Weight of sample} \times (100 - \%\ \text{moisture})} = \text{per cent } SO_4 \text{ (dry basis)}$$

Sec. 8C—Solubility and Packing Tendency

8C.1—*Apparatus:*

8C.1.1. A cork ring with an outside diameter of $2\frac{3}{4}$ in., an inside diameter of 2 in. and a depth of $\frac{3}{4}$ in.

8C.1.2. A single circular piece of 50-mesh monel metal cut slightly larger in diameter (about $2\frac{3}{4}$ in.) than the center of the cork ring (8C.1.1.). Form a cup $\frac{3}{16}$ in. in depth by turning up the outer edge. The diameter of the cup should be approximately $2\frac{3}{8}$ in. and it should have a flat bottom. Insert the cup into the cork ring. The bottom of the cup should be on the float side of the ring, held tightly in place by friction.

NOTE: Cheesecloth can be used in place of the monel metal cup. The cheesecloth should not have less than 64 threads to the inch one way and 48 threads to the inch the other way. Stretch the cheesecloth flat on the under side of the cork ring (8C.1.1) and glue it in place using a type of glue (sodium silicate glue) that will not allow the cheesecloth to become loose when immersed in water. It is advisable to have enough cheesecloth so that it can be fastened by glue to the vertical sides as well as the bottom of the cork ring. As an added precaution, a light piece of monel metal wire

can be twisted around the upwardly projecting cloth to keep it from slipping.

8C.2—*Procedure:*

8C.2.1. Screen a sample of the salt, keeping only that portion which passes a No. 8 sieve (U.S. Series) and is retained on a No. 50 sieve (U.S. Series). Weigh 20 g., ± 0.1 g., from this screened portion and place in the cup on the cheesecloth.

8C.2.2. Float the ring in a beaker containing 200 ml. of distilled water at 15°C., ± 1°C.

8C.2.3. The time for complete solution of the salt shall be not greater than 20 minutes.

Sec. 9C—Grease, Fat and Oil

9C.1. *Reagent.* Fat-free, anhydrous ethyl ether.

9C.2—*Procedure:*

9C.2.1. Weigh accurately approximately 5 g. of the sample dried to constant weight and place in a 70-ml. Soxhlet tube.

9C.2.2. Using about 100 ml. of anhydrous ethyl ether, extract the sample for two hours.

9C.2.3. At the end of the extraction, and after the ether is recovered in the usual way, dry the residue at 103°C. to constant weight.

9C.2.4. Evaporate 100 ml. of ethyl ether in a tared evaporating dish and subtract the weight of the residue from the weight of the residue obtained in 9C.2.3.

9C.3—*Calculation:*

$$\frac{\text{Net weight of residue}}{\text{Weight of sample taken}} \times 100$$

= per cent grease, fat and oil (dry basis)

Sec. 10C—pH Value

10C.1—*Reagents:*

(a) Neutral distilled water

(b) pH standards—chlorophenol red (4.8–6.4), phenol red (6.8–8.4), metacresol purple (7.4–9.0) and phthalein red (8.6–10.2)

10C.2—*Procedure:*

10C.2.1. A pH value shall be determined on a saturated salt solution at 25°C.

10C.2.2. Preferably, the determination shall be made electrometrically.

10C.2.3. When made colorimetrically with the indicators listed in 10C.1, it is usually necessary to dilute the sample slightly in order to bring out the color.

NOTE: If a colorimetric determination of pH value is to check with a potentiometric determination, the ionic strength of the solution under test must be the same as that of the buffer-color standards used. The usual Clark & Lubs buffers prepared and sold by most chemical houses vary from 0.05 *M* to 0.09 *M*, whereas the brine solution whose pH is determined is saturated and is approximately 6*M*. Under such conditions, the "salt correction" of the indicator will be appreciable and significant. Most important, however, is the fact that solutions of sodium chloride containing no excess acid or base are completely unbuffered and represent possibly the most difficult pH determination that ever needs to be made, since a mere trace of impurity will cause wide deviations in pH value. Should an unadjusted indicator be used, a pH value would be obtained more nearly that of the indicator itself than of the salt solution to be tested. If this determination is to be exact, the salt should be dissolved in freshly boiled and cooled distilled water avoiding reaeration as much as possible, and the pH determined potentiometrically. Reaeration alone can produce serious

errors, since the pH of distilled water in equilibrium with atmosphere is 5.75.

Sec. 11C—Phenolphthalein Alkalinity

11C.1. *Reagent.* Phenolphthalein indicator solution.

11C.2. *Procedure.* To approximately 50 ml. of the diluted filtrate from the insoluble matter made up as specified in 5C.2.1, add about three drops of phenolphthalein indicator.

11C.3. Development of a pink color indicates the presence of phenolphthalein alkalinity.

Sec. 12C—Total Impurities

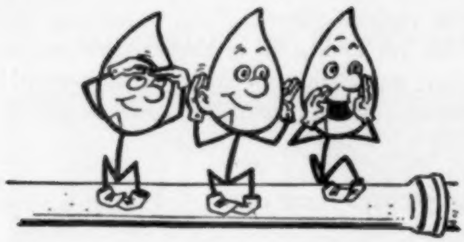
12C.1. *Water-soluble impurities.* The calcium (Ca), magnesium (Mg) and sulfate (SO_4) determined by chemical analysis shall be calculated to $CaSO_4$, $MgSO_4$, Na_2SO_4, $CaCl_2$ and $MgCl_2$ in accordance with the procedure for determination of hypothetical combinations described in *Standard Methods for the Examination of Water and Sewage* (ninth edition, Part I, Sec. 3, B, 1, page 7). Each salt impurity shall be reported in per cent by weight (dry basis).

12C.2. The sum of the soluble impurities present plus the insoluble matter (4C.2.) shall constitute the total impurities in the salt.

Sec. 13C—Sodium Chloride

The per cent of sodium chloride (NaCl) in the salt shall be obtained by difference:

$$100 - \%\ \text{total impurities} = \%\ \text{NaCl (dry basis)}$$



Percolation and Runoff

Commissioner Carney's capitulation to public pressure for a New York City cloud-busting expedition should make us happy. After all, haven't we been plugging weather modification—first by dry-ice and now by silver iodide—for nigh onto three years? Yet now we must admit that the well-advertised pilgrimage of the water commissioner of the world's largest city to the fount of rainmaking knowledge, for a heart-to-heart talk with General Electric's Doctors Langmuir and Schaefer, makes us a little sad. It isn't the fact that the commissioner's enthusiasm is tempered by a healthy respect for the legal difficulties involved in exploiting clouds which may belong to someone else. It isn't his worries about the responsibility for spoiling someone's picnic. It isn't even Dr. Langmuir's dangerous suggestion that adoption of a cloud-seeding program will obviate the provision of further reservoir capacity. It's just the fact that the commissioner committed himself to this business of shooting the breeze at the very moment when we were ready to sell him our own bill of goods.

Now our own bill is undoubtedly less romantic than dive-bombing the cumulus cottonpuffs of New York's well-scraped sky, less romantic even than firing an ack-ack of silver iodide from the tower of the Empire State Building, but you can't drink romance. And, as a matter of fact, some people still think that the sea is just as romantic as the sky.

What we're talking about, of course, is our most recent brainwave, which struck suddenly as we were riffing the pages of Neptune Meter Co.'s 1949–50 memorandum booklet. There, among the gems of "Useful Information," we found this vital item—*Sea water freezes at 27°F. The ice is* **fresh.** Presto! The drought was routed. And all that remained—and now must still remain—was to make arrangements with Commissioner Carney for transfer of a few stray icebergs to his reservoirs. The more we thought about the thing, the more it appealed to us. No millions of dollars of appropriations for research on vapor compression stills and multiple-effect evaporators as proposed in the President's budget. No interference

(*Continued on page 2*)

(*Continued from page 1*)

with the baseball schedule or with vacation plans. No . . . nothing, but a real boon to shipping, which has yet to win an argument with such a floating water supply. Ah us, that our genius should so be subrogated! Ah us, that we, of all people, must hide our light under a bushel to protect it from manmade rain!

If one tail can't wag a dog, perhaps forty can. At least, that's the thought that occurred to the Dearborn, Mich., city council in their advocacy of fluoridating the Detroit water supply. Thus, when their own request failed to elicit any "significant" response, the council forwarded its resolution to some 39 other surrounding communities and townships obtaining water from Detroit, suggesting that they, too, get into the swing of things. The recommendation that fluorides be added is supported, too, by a group of Detroit and Dearborn dentists, who are cooperating with the Dearborn officials in their drive.

Meanwhile, at Britton, S.D., the first fluoride *removal* plant in the country, developed under the joint auspices of Britton city officials and the dental division of the U.S. Public Health Service, got to work on the problem of de-mottling the teeth of Britton's small fry. And the U.S.P.H.S., whose Franz J. Maier deserves much credit for his work on development and construction of the Britton plant, began plans for another removal unit in Texas.

Now, of course, it remains for some Dearbornian to figure out how to mix Britton water and Detroit water to come out with a happy medium that will save both cities some money. Or, at least, Brittonians ought to be glad to sell their removed excess to Detroit.

"Water—why pray for it? Why not save what the Lord gave us?" asks an organization known as Friends of the Land ("a nonprofit, nonpartisan society for the conservation of soil, rain and man"). The result is the publication of the proceedings of the society's Eighth Annual Nutrition Conference in book form under the title *Water and Man.* Advance subscriptions, at $4.50 each, are being taken by Ollie E. Fink, Executive Secretary, who warns that such commitments are the only certain means for insuring reservation of a copy. A prospectus may be obtained from the society at 1368 N. High St., Columbus 1, Ohio. The chapter headings include such titles as "Water: the Basic Stuff of Things"; "The Splash of the Raindrop as a Major Factor in Soil Erosion"; "The Importance of Bio-elements in Our Drinking Water"; and "The Role of Water in the Metabolism of Man."

(*Continued on page 4*)

Drury-McNamee & Porter specified TOREX *in color for filters as early as 1937*

DRURY-McNAMEE & PORTER, Consulting Engineers, Ann Arbor, Michigan, specified Torex Enamel Deep Sea Green in 1937 for the submerged concrete filter basins at Highland Park, Michigan. Applied that year, Torex still beautifies the concrete.

What Torex means to the client. A novel idea it was at the time, to paint submerged concrete with a cheerful color. Now most engineers recognize that Torex Enamel brings a sparkle to the water, a new beauty to the plant. Because of the tilelike Torex finish, the plant stays spotlessly clean almost without effort. Deputy Superintendent Vern Hinebrook, pictured above, says: "I'm really proud of my filter plant!"

Why does Torex last so long? Constant submersion in water does not soften the resistant rubber base. Nor do chemicals like soda, alum and chlorine. Torex remains tough and hard. It adheres firmly to the concrete. It never peels, blisters or powders off.

It's easy to specify Torex. Sample Specification: "All concrete submerged in water shall be painted with one coat of Torex Undercoater (1 gallon, 200 square feet) and one coat of Torex Enamel (1 gallon, 250 square feet) in a color to be selected by the engineer."

If you wish to speak with the local Inertol representative about painting specs, please drop a postcard to:

INERTOL CO., INC.

19 South Park
San Francisco 7, Calif.

480 Frelinghuysen Avenue
Newark 5, N. J.

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(Continued from page 2)

Facing another March 15, we were startled at the announcement that the Franklin Savings Bank of New York is sponsoring a radio program which features "Minute Interviews" with its customers, designed to disclose "why people save." As if that were not enough of a shock in these days of the 1040 fight, the announcement was accompanied by a picture of Permutit Company's Norman Vogel at the interviewee end of one of those features. Glad enough to note that someone in the water works industry has been able to save, we should still point out that water works men as a whole would be much more likely to become Franklin customers if the interviews could tell them "how" rather than "why" to save, for water certainly isn't the only commodity in short supply.

Speaking of March, though, we remind you that the week beginning March 26, and including A.W.W.A.'s 69th birthday on the 29th, will, in our books at least (and probably at most), be Water Supply Week. Our only present plans for celebration of either include a pilgrimage to the water cooler and an appropriate personal toast to the industry. But one day we'll have a real week! Anyway, it's significant that this one ends on April Fool's Day.

(Continued on page 6)

CARSON CLAMPS
AND PEARLITIC CAST IRON BOLTS
Stop Joint Leakage
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There is a plus value in Kupferle Fire Hydrants. The Know How acquired through fifty years of continuous production.

Series 100 meet all A.W.W.A. specifications, tested and approved by Fire Underwriters.

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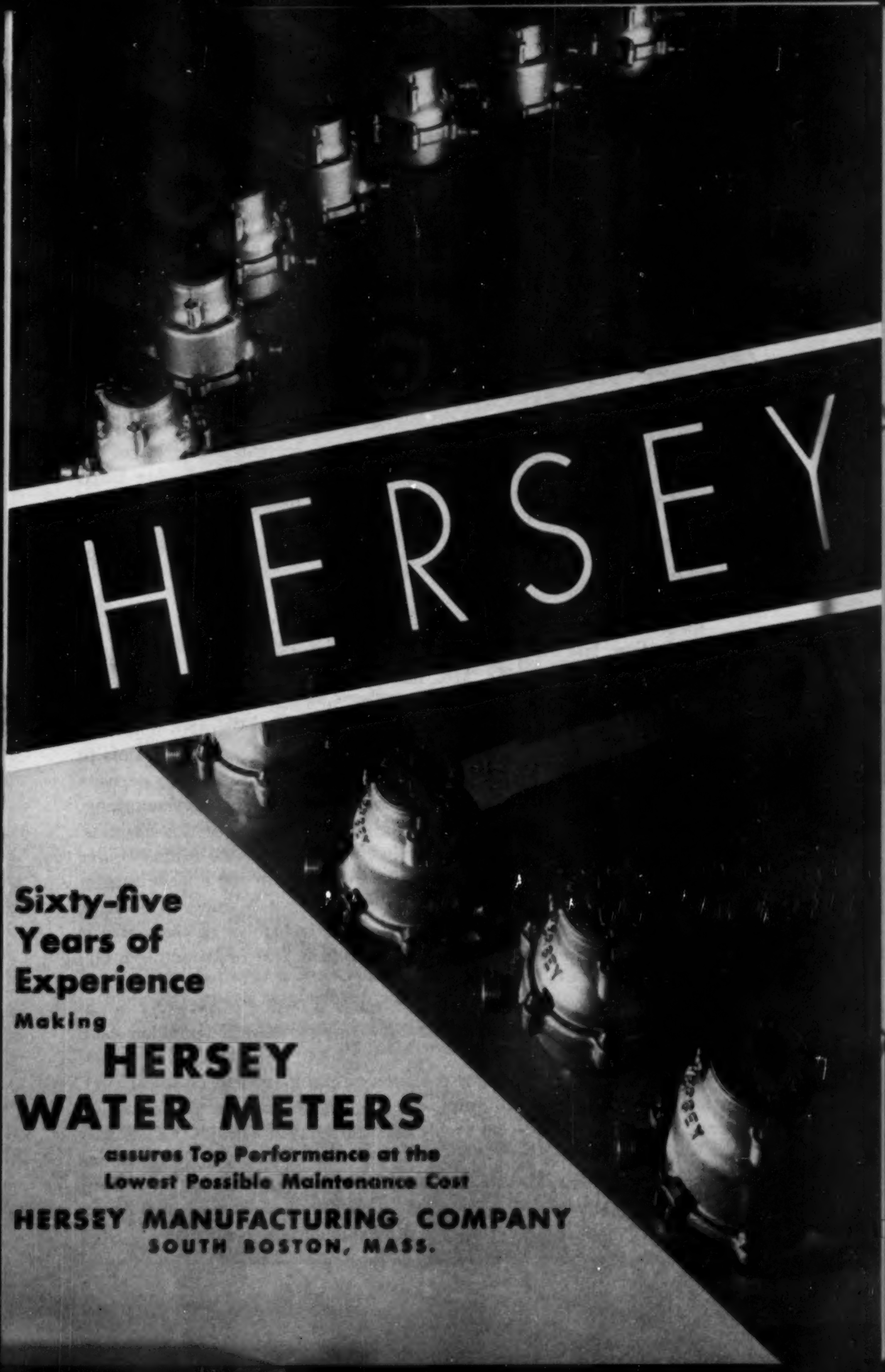

HERSEY
Sixty-five Years of Experience Making
HERSEY WATER METERS
assures Top Performance at the Lowest Possible Maintenance Cost
HERSEY MANUFACTURING COMPANY
SOUTH BOSTON, MASS.

(*Continued from page 4*)

A new edition of L. K. Spink's *Principles and Practices of Flow Meter Engineering*—the seventh since Foxboro Co. went into the publishing business in 1930—has just been issued. The 416-page handbook contains material on all phases of flow engineering, and includes a new section by R. L. Parshall on weirs and flumes. The price is $7.00, and the supplier is the company at Foxboro, Mass.

A bibliography of civil engineering subjects—including books of sanitary engineering, public water supplies, water supply engineering, sewerage and sewage disposal and such related topics as geology, hydraulics, hydrology and soil mechanics—has just been published as Section III on Civil Engineering of the "Selected Bibliography of Engineering Subjects" of the Engineers' Council for Professional Development. The books are listed as an aid to the engineer who plans to continue his studies or to build a private library in the field. Copies of Section III of the list may be obtained from the council, at 29 West 39 St., New York 18, N.Y., at a cost of 25¢ each.

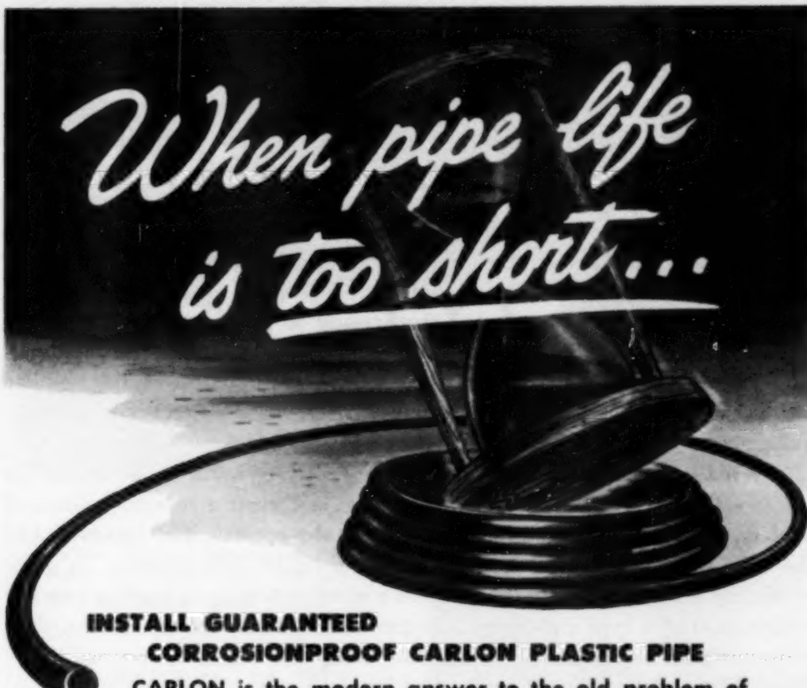
That the Atomic Age is really here was finally proved, at least to our satisfaction, last month, when we heard that the Shepard Bros., well drilling contractors of Pacific, Mo., had doubled their business in no time at all by offering a "uranium testing service" in conjunction with any well drilling they do. Equipped with a Geiger counter, the Shepards make on-the-spot tests of all well cuttings "at no extra cost" and waive all claims to any valuable finds by right of discovery. And although the two deposits they have put their finger on so far have been too poor to be worth working, the Shepards themselves are finding the prospecting a strike-it-rich business.

Next, on the basis of a statement in the *Journal of the Maine Water Utilities Association* that "no place in Maine is worth the expenditure of an atomic bomb by an enemy," we can predict that Maine will soon be billed as the "Shelter State." Certainly no alert chamber of commerce is going to pass up an appeal like that for the remote fear of attracting a target or two.

And on our own part, we must confess to a feeling of progress in patronizing the Atomic Dry Cleaners and in using our new H-bomb key case.

Edward Bartow, professor emeritus of chemistry and chemical engineering of the University of Iowa, rated a feature story in the *Iowa City Press-Citizen* on the occasion of his 80th birthday. The journalists may have been intrigued by the habit the A.W.W.A. Honorary Member and former President has of demonstrating his anniversary fitness by kicking as high as he is tall (and that's six feet), but they also showed a real appreciation of his many professional and academic accomplishments.

(*Continued on page 8*)



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CORROSIONPROOF CARLON PLASTIC PIPE

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Flexible and extremely light in weight, CARLON is easier and more economical to install. Long sections can be handled by one man, who can lay the pipe and then make joints in two minutes. In addition, many fittings necessary for ordinary pipe are completely eliminated.

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STD. SIZE	O. D.	I. D.	CALCULATED B. P. P. S. I.	WT./FT.	NORMAL SHIPPING LENGTHS
1/2"	0.840	0.622	540 lb.	0.103 lb.	400 ft. coils
3/4"	1.050	0.824	350 lb.	0.140 lb.	400 ft. coils
1"	1.310	1.070	200 lb.	0.181 lb.	300 ft. coils
1 1/4"	1.660	1.380	200 lb.	0.267 lb.	300 ft. coils
1 1/2"	1.900	1.610	200 lb.	0.320 lb.	250 ft. coils
2"	2.378	2.070	170 lb.	0.445 lb.	200 ft. coils
3"	3.504	3.070	165 lb.	0.91 lb.	100 ft. coils
4"	4.504	4.030	150 lb.	1.25 lb.	25 ft. str.
6"	6.630	6.070	115 lb.	2.23 lb.	25 ft. str.

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CLEVELAND 5, OHIO

(*Continued from page 6*)

Our ocean notion's now in motion. Only last month (Feb. P&R p. 8) we confessed to a fret over the sea depletion that would inevitably result from the success of the President's all-out program to distill salt water for public supply. And now we're faced with an even more fundamental foray into the whatwithal of our high seas in the recommendation of Thurlow C. Nelson, chairman of New Jersey's water supply policy commission, that we intercept all fresh waters before they run into the sea. As a matter of fact, Professor Nelson's idea of storing the flow of Jersey's rivers behind an integrated series of small dams with notched spillways makes a lot more sense than trying to reclaim the same waters after they have gone to sead—so much sense, really, that we're willing to subscribe to it at the expense of our own depletion theory, admitting that our oceans might still get those waters, only slightly later and slightly more used.

What's unusual about this nonseagoing plan of a latter-day Nelson is the fact that it proposes no federal project, not even a federally financed project, but a cooperative program between the communities involved and the state itself. The effectiveness of such a lot of little projects, in place of one big one, will, of course, depend to a great extent upon intercommunity cooperation of a type considerably superior to that so far demonstrated in pollution control projects. But, considering the highly urbanized character of the areas now afflicted by shortage, not to mention the political climate of the state as a whole, it appears that this is the only type of a program at all practical of adoption. And with public opinion in the area now at its ripest on the subject of water supply, this would seem the appropriate time to do something about it.

We, after all, can always go back to sailing our boat in the bathtub.

There are, of course, other ways—dozens of them in fact—by which New Jersey's present shortage can be overcome. And Charlie Capen, as head of the North Jersey District Water Supply Commission, is at the

(*Continued on page 10*)

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Prevent Sand Beds From Cracking
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Save Wash Water
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Higher Rates of Filtration

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A Dresser-coupled steel line delivers water cheaper...

In Springfield, Mass., as many as 40 long lengths of pipe were laid and joined in an eight-hour day, using a two-man joining crew.

The cheapest way to deliver water to the place where it turns into revenue is with a Dresser-coupled steel line—the line that

- **Cuts installation costs**
- **Cuts leakage losses**
- **Cuts maintenance costs**

Strong, shatterproof, yet lighter in weight, steel pipe swings into place easily. Each section goes as far as several sections of more cumbersome alternate pipe. You have fewer joints, and those more easily and quickly made with Dresser Couplings. Your line is in service sooner . . . you save costly man-hours.

The flexibility of Dresser Couplings cushions every joint and harmlessly absorbs vibration and other stresses that cause rigid lines to leak. You get a permanently tight line that delivers all the water you put into it.

You save on maintenance because the flexible-tight Dresser line "lives in the ground" comfortably and because modern glass-smooth linings assure high-sustained carrying capacity, life-long service.

See your Dresser Sales Engineer, or write today for literature.

Be sure you get the best line at the best price. Put steel pipe and Dresser Couplings in your specifications.

DRESSER "FLEXIBLE-TIGHT" **COUPLINGS**

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). In Texas: 1121 Rothwell St., Houston. In Canada: 629 Adelaide St., W., Toronto, Ont. Sales Offices: New York, Chicago, Houston, Philadelphia, San Francisco.

(*Continued from page 8*)

receiving end of more than his share of bright ideas. Of the two contributions quoted below: the first, of course, merits attention as a demonstration of serious concern and a desirable consciousness of the importance of water supply; the second needs no comment.

To the Wanaque Water Works:

It is a serious situation for a water works to run dry. Am giving an idea to avoid a crisis. I. Cities bordering the Ocean and salt water rivers could have mains installed in streets to supply all buildings with salt water for toilet flushing. II. Commercial garages and gas stations could use salt water to wash floors and platforms. III. It is sacrilegious to willfully waste fresh water. This should be announced in Churches. IV. If water wasters had to go thirsty in jail, they would think before they waste any more. I would like to visit the water works when I come up there.

To the North Jersey Water Supply Commission:

I know where is an underground river of sufficient volume to supply N.J., N.Y. and Philadelphia (& the rest of Penn.)

A tracer was put down and found the river ½ mile wide, 90 feet deep.

I am the only man alive who knows all details. Others know local evidence, but no more; and those, who know such, have no idea of there being a river.

I heard this first 40 years ago and have been piecing the puzzle together since, and have it ready to tell you for a test.

I want some individual, authorized to guarantee me a fair income for life then I'll tell you all about it. Understand I've waited 40 years for this. Enclosed is post card for Yes or No. I want your word for pay, but no pay unless you prove it's so 100%.

Ed Clark, chief engineer of the New York City water supply, has had his share of volunteered assistance, too, some of it impractical and a good deal of it not even printable. In an address before the New York Section (*see* p. 82), he pointed out that though "Dry Day" was the department's idea, it was the newspapermen who made it a "bathless, shaveless" day to sell it to the public. And in praising both press and public for their cooperation in meeting the city's crisis, he gave some hint of discomfort in the public eye by citing a letter from a lady constituent who accused him of wanting to make a dictator of her unborn child because he had asked the Board of Education to enlist the aid of schoolchildren in the conservation campaign—thereby presumably making them spy upon their parents for *der* state.

All in all, though, the public eye has been anything but evil, and if it can be kept in focus, water works men have much to gain.

James H. Pearcy, formerly with the Indianapolis Water Co., has joined the staff of Neptune Meter Co. as its Indiana representative.

(*Continued on page 12*)

IT'S ALWAYS OMEGA

THE LAST WORD IN FEEDERS

SUPER ACCURACY

When dry chemical feeding must be right, choose **Omega Loss-in-weight** — the Gravimetric Feeder with "super accuracy". Not only does this feeder deliver a steady flow of chemical with the amazing accuracy of 99% or better, but it also keeps a pound-by-pound tally of the amount fed. You know the rate and you know it's right.

"Super accuracy" is founded on the simple, dependable loss-in-weight feeding principle. This **Omega** Feeder handles granular or powdered materials at any set rate, over a 100 to 1 range. Each feeder is factory-calibrated for your particular job requirements — further assurance of faultless chemical feeding.

For engineering recommendations and Bulletins, address Omega Machine Company (Division of Builders Iron Foundry), Providence 1, R. I.

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Laboratory Stirrers
Dust Collectors
Chemical Elevators

THE LAST WORD IN FEEDERS

OMEGA

(*Continued from page 10*)

"The criminal pollution of streams" is one of the most popular of the stock phrases used to arouse the public to an awareness of the desirability of cleaning up its water sources. Leave it to New York State, though, to take the thing literally and to do something about *just that*. At any rate, with the completion last month of a $300,000 new, modern sewage disposal plant at Sing Sing Prison, New Yorkers can invoke the Bill of Rights to attest to the innocence of any other pollution they contribute to the Hudson River. Illiteral, ourself, we must, of course, contend: "Innocence is no excuse."

Speaking of literal New York, though, reminds us of the City's current anti-litter campaign, being conducted under the Sanitation Department's admirable slogan: "Don't Be a Litter Bug." Following some three weeks of educational and promotional activity, the department clamped down and arrested 230 litterers, who were haled into court and fined sums ranging from $1 to $25, depending upon the extent of their litterature. Even then, though, the City didn't collect enough cash to pay for the 228 new $10 wire trash baskets, which had vanished one by one from their sidewalk locations during the campaign. Wanna buy an incinerator?

Nuclear terrors have their limits, it seems, and water supply officials may catch what comfort they can from a little booklet entitled "Damage From Atomic Explosion and Design of Protective Structures." Prepared by the Dept. of Defense and the U.S. Atomic Energy Commission for the National Security Resources Board, the moderately glad word is that ground shock from an atomic burst in the air might damage tile sewers, but that "metal piping would probably not be harmed except where it was exposed to disruption by damage to surrounding structures. . . ." It is nice to know that our distribution grids may remain intact—even though the people and structures they were intended to serve have been obliterated.

(*Continued on page 14*)

Loose-Leaf BINDERS

for A.W.W.A. Standards

Price $2.50

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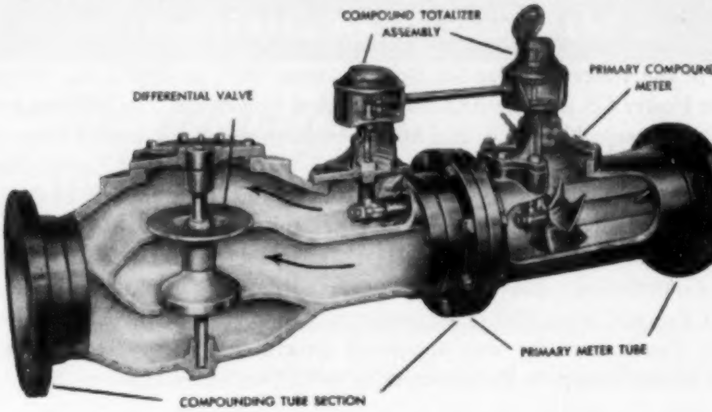
500 Fifth Ave. New York 18, N.Y.

Sturdily bound in blue canvas with lettered backbone, the binder has durable metal hinges, capacious 1½-in. rings and eight blank separator cards with projecting tabs. All A.W.W.A. specifications will be provided punched to fit the binder as soon as the older stocks have been exhausted.

SPARLING MAIN-LINE METERS



Differential valve cracks at about one pound per square inch back pressure from the smaller meter. The smaller meter measures all flows below the minimum accurate range of the larger meter. Both meters drive through ratchet clutches to a common totalizer, which thus operates with the faster turning meter.

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Important, too, are high conservation of pressure in the line, the single totalizer for easy reading, and the elimination of sharp cutover point between the two elements!

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(*Continued from page 12*)

John H. Cook, retired general manager of the Paterson, N.J., water system and A.W.W.A. Honorary Member, died on January 30, at the age of 90. His many achievements include research and work on the development of the water supplies for Boston (from 1876 to 1897), the Holyoke Water Power Co. and the Ansonia Land and Power Co. In 1897 he joined the East Jersey Water Co. and helped build many of the state's water systems. For many years he was a governor of the Society of Useful Manufactures, and also served as general manager of its hydro and steam generating plants at Passaic Falls. When the properties were acquired by the city of Paterson, he became consultant to the Paterson Plant Management Commission. He was long connected with the Passaic Consolidated Water Co., and when that organization was succeeded by the Passaic Valley Water Commission he was appointed general manager. He retained a status as consultant to the commission until two years ago.

Cornelius Clarkson Vermeule, consultant and for most of his life a resident of East Orange, N.J., died on February 1 at the age of 91. He was educated at Rutgers University, from which he was graduated in 1878, receiving the degrees of master of science and civil engineer two years later. After some years in the preparation of topographic maps and the investigation of water resources for the New Jersey and United States geological surveys, he opened a consultant's office in New York in 1888. Among his many accomplishments are the surveys he made for storage reservoirs on the Croton River, the investigation of the Ramapo as a source for Brooklyn, the design and construction of the water works for East Orange, Sussex, Bordentown, Cape May and the Hudson County Water Co. in New Jersey, and Hudson, N.Y. Other projects included sewer systems and sanitary and hydraulic installations for Cienfuegos and Cumajuani, Cuba. He closed his New York office in 1943 but maintained his consulting status until 1947, when he retired completely.

(*Continued on page 16*)

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Write for Bulletin 6S6

Orlando, Florida Installation

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PROQUIP

(*Continued from page 14*)

Inflation-struck water works ought to get many millions of dollars of relief during 1950 if the estimates of the New York *Times* concerning expenditures on waste water control equipment are anywhere near accurate. With industry's own expenditures on treatment and control set at more than a billion dollars and that amount more than matched by expenditures of public works funds, the resultant let-up in pollution should certainly effect a significant reduction of the public water supply treatment burden. It is, of course, going to take a good many years of such spending before water users generally will be leaving water in as good condition as they found it, but every big bit helps.

One of the happy signs of these times is that industry has come around to considering the costs of waste treatment as a basic part of manufacturing overhead, a step which should pave the way toward adequate appreciation of the industrial waste problem. Meanwhile the U.S.P.H.S. Water Pollution Control Advisory Board is setting up a National Technical Task Committee on Industrial Waste, which gives even more promise that the waste problem is from now on going to get the full treatment. And what more dramatic example of the need for such an approach than the experience of the Atomic Energy Commission in disposing of its radioactive wastes.

Our sudden realization that industrial waste treatment is by way of being a billion dollar business was prompted no little by the simultaneous transformation, last January, of *Sewage Works Journal* into *Sewage and Industrial Wastes; Sewage Works Engineering* into *Sewage and Industrial Wastes Engineering;* and the Canadian *Water and Sewage* into *Water and Sanitation.* Lone holdout now appears to be *Water and Sewage Works,* but who can tell when it will become *Water and Wastes?* As for ourselves, we're giving some rather serious thought to the idea of becoming *Journal American Water Works and Atomic Energy Association.*

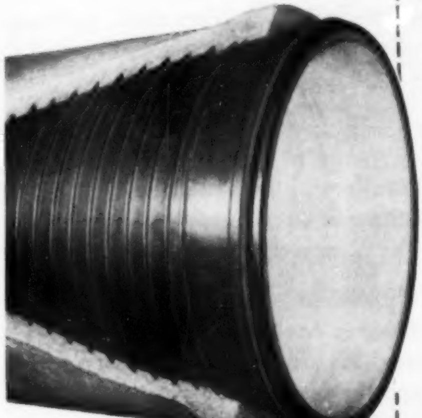
L. M. Fisher was the guest of honor at a dinner given by his friends and associates in Washington on the occasion of his resignation, after 31 years of service, from the Public Health Service. He is now engineering field associate of the American Public Health Assn., and will study the administrative and technical practices of the most successful local health departments in the hope of establishing some standards for organization and personnel qualification which will give greatest assurance of successful operation.

James G. Woodburn, professor of hydraulic engineering at the University of Wisconsin, has been appointed chairman of the Department of Civil Engineering.

(*Continued on page 18*)

CONSIDER THESE ADVANTAGES OF AMERICAN CONCRETE CYLINDER PIPE

—for main water transmission lines



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Cutaway illustration shows spigot end of 24″ diameter American Concrete Cylinder Pipe which employs the Lock Joint Rubber Gasket type of closure. This pipe is manufactured in diameters of 14″ through 42″, in nominal laying lengths of 30′, and for operating pressures of 100 psi and greater.

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√ Has ample strength for the occasional concentrated loading which is sometimes met in practice.

√ Will remain water tight under conditions of foundation settlement or soil movement within the limits generally met in water works practice.

√ Has a long life with freedom from corrosion or deterioration. Concrete encasement protects steel cylinder and reinforcement from electrolytic action and deleterious ground water.

√ Has a conservative design basis and assumed unit stress which provide ample factor of safety for all normal conditions of service including surge and water hammer.

√ Will safely withstand sudden and extreme increases of pressure, or other disturbances, which might tend to burst or shatter ordinary types of pressure pipe having less elasticity.

√ Has ample strength to withstand all normal handling conditions.

Complete information is available upon request

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(Continued from page 16)

Arthur D. Weston has retired as deputy commissioner and director of the division of sanitary engineering of the Massachusetts Dept. of Public Health. He had been associated with the Massachusetts health service since 1905, with a period of military service during World War I. He had been director and chief sanitary engineer for his division since 1930, and was designated deputy commissioner in 1948. Under his direction have been more than 50 special investigations in water supply and other sanitary matters.

C. C. Moore, Atlantic district manager for Rockwell Mfg. Co., has been transferred to manage that company's new district office in Columbus. He has been associated with the Rockwell organization since 1930, when he became manager of meter parts for Pittsburgh Equitable Meter Co. He is being succeeded at Atlanta by J. W. Northcutt.

Thomas L. Young, retired manager of the South Side Water Works Co. and Fuller Awardee and former director of the West Virginia Section, was made a life member of A.W.W.A. by action of the Board of Directors on January 17. Normally automatic after 30 years in A.W.W.A., life membership was conferred by the board nearly two years early, in recognition of his retirement after years of service both to the industry and to the Association.

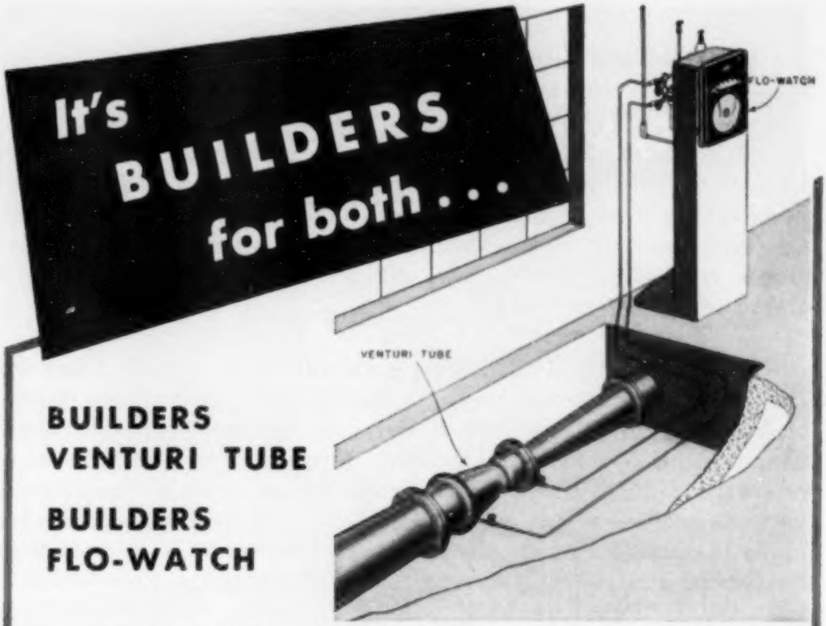
Ernest W. Steel has joined the faculty of the University of Texas as professor of civil engineering, taking charge of the sanitary engineering curriculum and research. He had been serving in Venezuela since 1943, first as chief of field party for the Institute of Inter-American Affairs and, since 1946, as civilian consultant to the Venezuelan government.

J. W. Simpson, executive vice-president of Mueller Co., has just concluded 50 years of service with the firm, having been hired at the age of 16 in 1899. At ceremonies honoring his service, it was observed that he is the company's senior employe and the only one to have worked with its founder, Hieronymus Mueller.

Harry E. Wild, formerly with Russell & Axon, has opened with Harold D. Briley the consulting firm of Briley, Wild and Associates. Offices are at 550 N. Oleander Ave., Daytona Beach, Fla.

George R. Spalding's retirement as sanitary engineer of the Hackensack Water Co. has brought about a series of personnel changes in that organization: Peter E. Pallo, formerly assistant sanitary engineer, becomes sanitary engineer; Adolph Damiano, formerly distribution engineer, is now assistant chief engineer; and Edward Walasyk, previously assistant engineer, is promoted to distribution engineer.

(Continued on page 20)



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BUILDERS-PROVIDENCE
Instruments

(*Continued from page 18*)

Hitchcock and Estabrook, consulting firm of Minneapolis, Minn., has opened a branch office at 241 Sheridan Road, Menominee, Mich.

Reagents needed for the Biedermann-Schwarzenbach determinations for hardness (*see* January JOURNAL, p. 39, text section) will soon be listed in the catalog of the Distillation Products Industries Div., Eastman Kodak Co., Rochester 3, N.Y. The chemicals to be furnished are disodium dihydrogen ethylenediaminetetraacetate dihydrate (ethylenediaminetetraacetic acid) and Eriochrome black T.

Is water in the Philadelphia area soft, or is it hard? asked the *Inquirer,* and straightway began an inquiry. The result is an 18-page booklet, complete with maps, which offers soap and detergent manufacturers the interesting conclusion that in some districts water is soft, whereas in others the hardness is high enough, presumably, to create an eager market for soaps and detergents. Chemical analyses of all the important supplies in the 14-county region are also provided. Copies may be obtained from the General Promotion Dept., The Philadelphia Inquirer, Philadelphia 1, Pa. Ask for "Philadelphia Market Facts—Fifth of a Series: Water."

A chemical proportioning pump designed to handle 35 to 40 per cent ferric chloride solutions for sludge conditioning has been announced by Proportioneers, Inc. Known as the Ferro-Feeder, the unit has been made corrosion-resistant by the use of special rubber and alloy parts. A capacity of up to 1 gpm. with adjustable feeding and accurate measurement of the liquid fed is featured.

A cold liquid cleaner for electric motors and generators has been developed by Du Pont Co., and is said to dissolve grease rapidly, evaporate quickly and have low flammability and toxicity. It is practically inert to ordinary insulating materials. The compound may be prepared by mixing 30 per cent by volume of "Blend CC No. 49" with 70 per cent Stoddard Solvent. The latter is not available from Du Pont, but many Du Pont distributors are prepared to supply the complete mixture, which is known as "Cleaning Mixture No. 49." It is also said to be effective for general machine and automotive maintenance.

A meter reading or service order card carrying case has been developed by Remington Rand for utility service men. The leather wallet-type case holds 6 × 4 in. cards on which orders or readings can be entered. A closed pocket holds the forms which have been filled out. Further details are available from any branch of the company, or headquarters at 315 Fourth Ave., New York 10.


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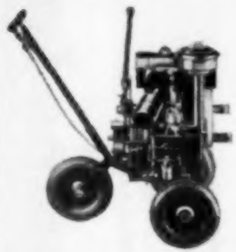
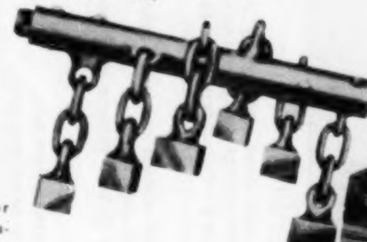


Above "Flexible" Power Driven Pipe Cleaning Machine. Fast. Powerful. Safe.



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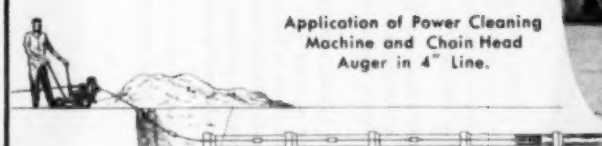

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Correspondence

Errors and Arrears

To the Editor:

I read with interest the report, page 12, rear section, January issue of the JOURNAL, on one Dr. Costello, and comment as follows:

When the man registered, he gave me a check for $6.00, the nonmembership rate. I figured he was a "phony," and remarked to the girl at my side that it would take me longer to cash the check than it did for him to write it, but for obvious reasons, I could not challenge him.

The thing I am trying to emphasize—he did not trim the Section for $50, as published, but received only a free registration from the Secretary.

L. A. JACKSON

Secretary-Treasurer
Southwest Section, A.W.W.A.
Little Rock, Ark.; Jan. 24, 1950

P.S. I have asked the Board of Trustees to establish a registration fee for frauds.

In thanking Secretary Jackson for straight dope on a crooked one, we beg off with Will Rogers' "I only know what I read in the papers" and confess to feeling properly chastised with our relegation to the "rear."—ED.

Cucurbitaceous Rhabdomancy

To the Editor:

I have read with interest your frequent references to the art of "Dowsing" as applied in your country. The below-quoted news item broadcast over our national stations indicates that Australian followers of the "Art" are not lacking in initiative when their "gifts" can be applied for personal comfort:

"A man who bought a water melon from a Burleigh Heads storekeeper yesterday used his skill as a water diviner to make sure he got the perfect melon.

"He walked to the water melon counter, produced a small twig from his wallet, held it over one melon, watched the vibrations, shook his head and moved on to the next melon.

"Meanwhile, a small crowd had gathered. At the seventh melon the crowd saw the diviner express his satisfaction, and cut a small section from the melon to demonstrate its perfect maturity.

"He then paid four shillings and took the melon without leaving his name."

M. A. SIMMONDS

502 Main Coast Road
Scarborough, Queensland, Australia; Jan. 6, 1950

Not to let our friends from "Down Under" end up on top, we might cite the instance of a Wall Street acquaintance who makes a similar check for water in the stock of his every speculation. Since he won't cut a piece out of his bank account to demonstrate success, however, we can't prove our point and must, thus, yield to the practicality of the melon master.—ED.

Odor on the Threshold

To the Editor:

Re your January 1950 "new look" . . . Pfuie! . . . If I were not polite, I'd say it is a real "blue-green algae bloom"—and that really stinks!

E. L. FILBY

Black & Veatch, Cons. Engrs.
Kansas City, Mo.; Feb. 2, 1950

Friend Filby went on record as a picover lover, but what say you "contents" contenders: fragrant or flagrant?—ED.

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Membership Changes

NEW MEMBERS

Applications received January 1 to 31, 1950

Agramonte, Tomas S., Sales Repr., Mueller Co., Edificio Cuervo Rubio 21 y O, Vedado, Havana, Cuba (Jan. '50) *M*

Argos Water Works, Theodore Stichler, Supt., Argos, Ind. (Corp. M. Jan. '50) *MPR*

Ayer, Glen O., Supt. of Water, Lancaster, Mo. (Jan. '50)

Baker, Frank W., Sales Repr., R. D. Wood Co., 1124 Drummond Ave., Charlotte, N.C. (Jan. '50) *M*

Belle Glade Water Dept., C. H. Throop, Water Supt., City Hall, N.W. Ave. A, Belle Glade, Fla. (Munic. Sv. Sub. Jan. '50) *MP*

Bengel, William C., Director of Public Works, Eng. Dept., Municipal Bldg., Temple, Tex. (Jan. '50)

Benjes, Henry H., Sr. Designing Engr., Black & Veatch, 4706 Broadway, Kansas City 2, Mo. (Jan. '50)

Benson, Curtis Carlyle, Student, San. Eng., Univ. of Minnesota, Osseo, Minn. (Jr. M. Jan. '50)

Berry, H. E., Supt., Public Utilities Com., Port Stanley, Ont. (Jan. '50)

Bosch, Felipe, Operations Supt., Puerto Rico Aqueduct & Sewer Authority, Fez. Juncos Stop 26½, Box 2832, San Juan 12, Puerto Rico (Jan. '50) *M*

Brookneal Mills, Div. of Pacific Mills, Clyde B. Rowntree, Resident Chemist, Brookneal, Va. (Corp. M. Jan. '50) *MP*

Bruce, Frank Edward, Imperial College of Science & Technology, London S.W. 7, England (Jan. '50) *MPR*

Bumgardner, George, Owner, George Bumgardner Water Co., 1125—11th St., Modesto, Calif. (Jan. '50)

Butler, Harold E., Water Engr., Public Service Dept., 119 N. Glendale Ave., Glendale 6, Calif. (Jan. '50) *MP*

Byrd, Paul R., *see* West Memphis Light & Water Dept.

Chambers, Dennis, *see* Monticello Water Works

Clark, Benjiman F., Supt., Power & Water Works, Central Louisiana Hospital, Pineville, La. (Jan. '50) *M*

Coburn, Barney L., Supt., Water, Light & Bond Com., Fitzgerald, Ga. (Jan. '50) *M*

Collingwood Public Utilities Com., W. G. Lane, Supt., Hurontario St., Collingwood, Ont. (Corp. M. Jan. '50)

Cothran, A. B., Distributor, Refinite Sales Co., 1627 W. Fort St., Detroit, Mich. (Jan. '50) *P*

Cox, Donald E., Supt., Water Dept., Bicknell, Ind. (Jan. '50) *MPR*

de Sousa Taveira, Antonio Augusto, Civ. Engr., Asst. of Hydr., Eng. Faculty, Univ. of Oporto., Rua dos Bragas, Porto, Portugal (Jan. '50) *MP*

Electric Auto Lite Co., Allen M. Reed, Water & Waste Treatment Supervisor, Lockland 15, Ohio (Corp. M. Jan. '50) *PR*

Fosheim, Ivan V., Supt., Water Works, 235 Wessen St., Pontiac, Mich. (Jan. '50)

Fuerness, William, Member, Water Board, 88 Dunning Ave., Webster, N.Y. (Jan. '50) *M*

Galbraith, W. J., *see* Potomac Elec. Power Co.

Goshen Water Works, M. J. Miller, Supt. of Utilities, Goshen, Ind. (Corp. M. Jan. '50) *MPR*

Greenshields, Robert E., Supt. of Power & Maint., Springfield State Hospital, Sykesville, Md. (Jan. '50) *M*

Grobart, Samuel, Comr., Passaic Valley Water Com., 13½ Van Houten St., Paterson 1, N.J. (Jan. '50)

(*Continued on page 30*)

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(*Continued from page 28*)

Guthrie, Asa E., Chemist, Water, Light & Power Dept., Peru, Ind. (Jan. '50) *MP*

Hoge, Charles C., II, San. Engr., Capitol Eng. Corp., Dillsburg, Pa. (Jan. '50) *PR*

James, Roger, San. Engr., State Dept. of Health, 423 Hutton Bldg., Spokane, Wash. (Jan. '50)

Karns, Harry Donavon, Salesman, Ohio Salt Co., 1005 Jackson Blvd., Rochester, Ind. (Jan. '50)

King, Donald W., Member, Water Board, 118 Dunning Ave., Webster, N.Y. (Jan. '50) *R*

Lane, W. G., *see* Collingwood Public Utilities Com

Langworthy, Virgil Walter, Operator, Water Conditioning Plant, Board of Water & Elec. Light Comrs., Lansing, Mich. (Jan. '50) *MP*

Lollis, William Roy, Water & Sewer Supt., Weleetka, Okla. (Jan. '50)

Longley, Herbert L., Supt., Whittier Water Co., Valinda & Maple Grove Ave., Puente, Calif. (Jan. '50) *M*

Maihock, Donald J., Asst. Engr., Alvord, Burdick & Howson, 1401 Civic Opera Bldg., 20 N. Wacker Drive, Chicago 6, Ill. (Jan. '50)

Manley, Robert M., Dist. Sales Mgr., Smith-Blair, Inc., 535 Railroad Ave., South San Francisco, Calif. (Jan. '50) *M*

McDermitt, James G., Supt., Water Works, Pineville, W.Va. (Affil. Jan. '50) *MP*

McDonald, Thomas W., Zone Supervisor, East Bay Munic. Utility Dist., 926—30th St., Richmond, Calif. (Jan. '50)

McIntosh, Russell W., Sales Engr., Pittsburgh Coke & Chemical Co., Tar Coatings Div., 1204 Russ Bldg., San Francisco 4, Calif. (Jan. '50) *M*

McIntyre, William James, Water Meter & Service Supervisor, Div. of Meters & Services, City of Milwaukee, 200 E. Wells, Milwaukee, Wis. (Jan. '50) *M*

Michels, Joseph A., Registered Professional Engr., R.D. 1, Dallastown, Pa. (Jan. '50) *MR*

Middleton, Arthur B., Chem. Dept., Philadelphia Quartz Co., Public Ledger Bldg., Philadelphia 6, Pa. (Jan. '50) P

Miller, M. J., *see* Goshen Water Works

Monticello Water Works, Dennis Chambers, Supt., Monticello, Ind. (Corp. M. Jan. '50) *MR*

Moran, Carlos, Corp. Counsel, Western Union Bldg., Obispo & Havana Sts., Havana, Cuba (Jan. '50) *M*

Mullen, T. L., Mayor & Supt., Water Works, Huntersville, N.C. (Affil. Jan. '50) *M*

Norris, Alfred O., Vice-Pres. & Gen. Mgr., Indianapolis Water Co., 113 Monument Circle, Indianapolis 6, Ind. (Jan. '50)

Panesi, Richard C., Asst. Supt. of Filtration, Denver Board of Water Comrs., Route 2, Box 105, Littleton, Colo. (Jan. '50)

Pearson, Harold E., Research Chemist Metropolitan Water Dist. of Southern California, Box 38, La Verne, Calif. (Jan. '50) *P*

Pena Mimensa, Jose F., Sales Repr., National Supply Co., 365 Empedrado St., Havana, Cuba (Jan. '50)

Pfeil, Robert M., Supt., Water Dept., Portage, Wis. (Jan. '50) *MPR*

Pomares, Marino L., Partner, Culligan Soft Water Service, 3516 Highland Ave., Manhattan Beach, Calif. (Jan. '50)

Potomac Elec. Power Co., W. J. Galbraith, Mgr., Government Sales, 929 E St., N.W., Washington, D.C. (Corp. M. Jan. '50) *M*

Price, Joseph W., Public Health Engr., Washtenaw County Health Dept., Ann Arbor, Mich. (Jan. '50) *PR*

Raney, Fred M., Storekeeper, Water Dept., 1612 E. Wardlow Rd., Long Beach 7, Calif. (Jan. '50) *M*

Redar, Peter G., Supt., Water Works, Schererville, Ind. (Jan. '50) *M*

Reed, Allen M., *see* Electric Auto Lite Co.

Roller, Raymond, Supt., Water Dept., Phillipsburg, Kan. (Jan. '50) *M*

Ross, Arthur A., Dist. Engr., Board of Fire Underwriters of the Pacific, 1114 Boston Bldg., Salt Lake City, Utah (Jan. '50) *MR*

Rowntree, Clyde B., *see* Brookneal Mills

Schaffer, W. A., Supt., Water Dept., Syracuse, Kan. (Jan. '50)

Sells, James H., Sales Engr., Rockwell Mfg. Co., Box 290, Alexandria, La. (Jan. '50)

(*Continued on page 32*)

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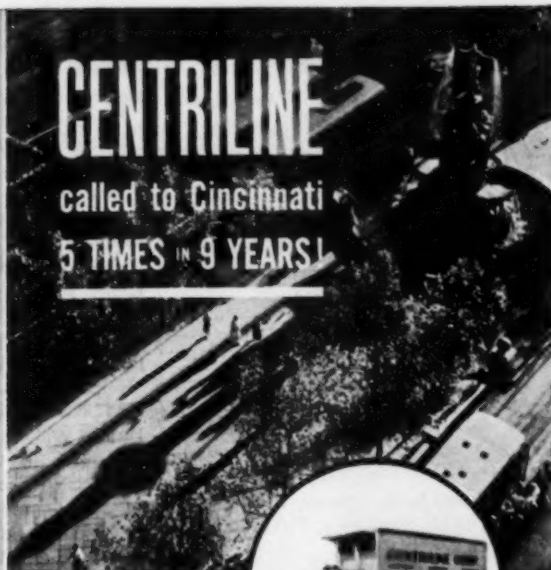

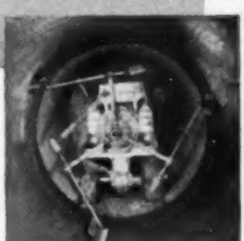

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(*Continued from page 30*)

Shelton, James, Supt., Water Works, Lyons, Ind. (Jan. '50)

Sherrill, T. Russell, Supt., Water Dept., Mooresville, N.C. (Jan. '50) *M*

Smith, J. Claude, Mgr. & Supt., Munic. Authority of the Borough of Carmichaels, Carmichaels, Pa. (Jan. '50) *M*

Snyder, Kenneth T., Gen. Mgr., The Atlas Mineral Products Co. of Texas, Inc., Box 252, Houston, Tex. (Jan. '50) *M*

Stichler, Theodore, *see* Argos Water Works

Stone, Wilbur F., Mech. Engr., U.S. Bureau of Mines, Anvil Points No. 45, Rifle, Colo. (Jan. '50)

Streit, John Henry, Engr., Wallace & Tiernan Sales Corp., 1120 S. Logan, Denver, Colo. (Jan. '50) *P*

Stroh, Charles Kirk, Partner, The Chester Engrs., 210 E. Park Way, Pittsburgh 12, Pa. (Jan. '50) *P*

Sundin, Hjalmar S., Asst. in Civ. Eng., Univ. of Illinois, Urbana, Ill. (Jr. M. Jan. '50) *MP*

Throop, C. H., *see* Belle Glade Water Dept.

Todd, Lee Oliver, Head Operator, Filtration & Pumping Station, Ardmore, Okla. (Jan. '50) *M*

Veitch, William Martin, Public Health Engr., Box 781, London, Ont. (Jan. '50)

Walsh, Raymond, San. Eng. Asst., Dept. of Water & Power, 207 S. Broadway, Los Angeles, Calif. (Jan. '50) *MP*

West Memphis Light & Water Dept., Paul R. Byrd, Mgr., West Memphis, Ark. (Corp. M. Jan. '50) *M*

White, W. F., Chief Engr., Oregon Insurance Rating Bureau, Box 70, 401 Lumbermens Bldg., Portland 7, Ore. (Jan. '50) *MR*

Yelton, Paul H., Constr. Engr., California Elec. Power Co., Box 512, Riverside, Calif. (Jan. '50) *M*

REINSTATEMENTS

Abell, D. S., Chief Engr., Cooperative Health Services, c/o U.S. Embassy, Montevideo, Uruguay (Nov. '32)

Atkinson, V. E., *see* Victoria Water Dept.

Bass, John Howard, Infilco, Inc., 2735 Kent Rd., Columbus 8, Ohio (Oct. '46)

Bear, Ernest J., *see* Livingston Water Dept.

Belco Industrial Equipment Div., Edward P. Schinman, Pres., 52 Iowa Ave., Paterson, N.J. (Assoc. M. July '46)

Billings, Clayton H., Sr. Engr., Bureau of San. Eng., State Dept. of Health, Austin 2, Tex. (Oct. '43) *P*

Bowser, Orval A., Supt., Water Works, Box 21, Kittanning, Pa. (Apr. '40)

Brady, E. J., Maint. Supt., Div. of Water, 27 Vermont St., Buffalo 13, N.Y. (Oct. '47)

Brannock, Durant York, Chem. Engr. & Supt. of Sewage Treatment, 1509 Beal St., Rocky Mount, N.C. (Oct. '39) *MP*

DuLac, William D., Dist. Mgr., Pittsburgh Pipe Cleaner Co., 544 New Center Bldg., Detroit, Mich. (July '46)

Fitzpatrick, Joseph W., Sales Repr., Ludlow Valve Mfg. Co., Inc., 517 R. A. Long Bldg., Kansas City 6, Mo. (Apr. '44)

Healy, William A., Director, Div. of San. Eng., State Dept. of Health, State House, Concord, N.H. (Jan. '45)

Heeney, Carden Thomas, Engr., Purif. & Pumping Div., Water Works Dept., 48 Rideau St., Ottawa, Ont. (Jan. '48)

Krumm, Tahlman, Cons. Engr., 65 Meadow Park Rd., Bexley, Columbus 9, Ohio (Jan. '38)

Livingston Water Dept., Ernest J. Bear, Supervisor of Water & Sewers, 107 Hillside Ave., Livingston, N.J. (Corp. M. Jan. '38)

Pegg, J. F., Supt., Water Works Dept., Public Utilities Com., Blenheim, Ont. (Jan. '48) *M*

Pell, William I., c/o Worth Steel Co., Claymont, Del. (July '45)

Schinman, Edward P., *see* Belco Industrial Equipment Div.

Trout, Clarence L., Cincinnati Gas & Elec. Co., 323 Plum St., Cincinnati, Ohio (Jan. '39)

Victoria Water Dept., V. E. Atkinson, Supt., Victoria, Tex. (Corp. M. Apr. '47) *M*

Williams, Johnie E., Indus. Extension Service, Texas A & M College, College Station, Tex. (Apr. '47)

Wright, J. W., City Clerk & Treas., Barnard Ave., Vernon, B.C. (Jan. '45)

(*Continued on page 34*)

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(Continued from page 32)

Young, Thomas L., Chester, W.Va. (June '21) *Fuller Award '42. Director '43–'46.*

LOSSES

Deaths

Barclay, L. W., Public Relations Director, Dept. of Water & Power, 207 S. Broadway, Los Angeles, Calif. (Oct. '45) *MPR*

Birkeness, O. T., 418 Meacham Ave., Park Ridge, Ill. (May '30) *P*

Breedlove, H. E., Public Health Engr., Mobile County Board of Health, Box 489, Mobile 3, Ala. (Oct. '49)

Cook, John H., 243 Walthery Ave., Ridgewood, N.J. (July '06) *Honorary M '47.*

Dummer, Otto W., Supt. of Meters & Services, Water Works, 109 City Hall, Milwaukee 2, Wis. (Jan. '42)

Gibson, Roy E., Operator, Filtration Plant, 343 High St., Bellevue, Ohio (Oct. '48)

Heath, A. E., Supt. of Distr., City Water Dept., Box 958, Billings, Mont. (Apr. '40)

Johnson, E. Harold, Florida Repr., A. P. Smith Mfg. Co., Box 1704, Orlando, Fla. (Oct. '41)

Maxwell, C. H., Supt. of Water, Colton, Calif. (Oct. '37)

Pierron, L. L., City Chemist, Water & Sewage, City Bldg., Greenville, Ohio (Oct. '47)

Seydel, Raymond, Chemist-Bacteriologist, City Water Works, 4500 Reservoir Blvd., Minneapolis 18, Minn. (July '46)

Shank, John J., Chemist & Bacteriologist, Wayne Labs., 17 E. Main St., Waynesboro, Pa. (May '30) *P*

Tomkinson, P. K., Intake Supervisor, Phoenix Water Dept., Ft. McDowell, Ariz. (Oct. '47)

Vermeule, Cornelius Clarkson, Cons. Engr., Box 263, New Brunswick, N.J. (June '09)

Resignations

Barney, Ray, Asst. Supt., Water Dept., City Hall, 15 Fox St., Aurora, Ill. (Apr. '47) *M*

Clark, Joseph R., E. I. du Pont de Nemours & Co., Belle Works, Tech. Section, Charleston, W.Va. (Apr. '44)

Cox, Rupert Leslie, Chemist & Chem. Engr., E. I. du Pont de Nemours & Co., Inc., Box 1477, Richmond 12, Va. (Oct. '47) *MP*

Fraser Utility Supply Co., R. J. Fraser Jr., Box 1655, Glendale 5, Calif. (Assoc. M. Oct. '38)

Hanemann, Eric J., San. Engr., Gilbert Assoc., Inc., 708 Lamar Ave., Houston 2, Tex. (Oct. '48)

Hendricks, R. W., Engr., Hydr. Dept., Underwriters Labs., Inc., 207 E. Ohio St., Chicago 11, Ill. (Apr. '23) *MR*

Heppenstall, Thomas Arthur, 45 Derby Rd., Beeston, Nottingham, England (Apr. '46)

Hope, Malcolm C., San Engr., Office of Hospital Services, Div. of Hospital Facilities, U.S. Public Health Service, Washington 25, D.C. (Jan. '45) *P*

Liffen, John James, Assoc. Engr., Associated London Properties, Ltd., 58 Hendham Rd., Wadsworth Common, London S.W. 17, England (July '38) *M*

Norton, John F., Head, Dept. of Bacteriological Research, Research Div., The Upjohn Co., Kalamazoo 99, Mich. (May '26) *P*

Paterson, Alexander McCulloch, Chief. Engr., Bristol Waterworks Co., Telephone Ave., Bristol, England (Jan. '45)

Smith, Sydney H., Route 4, South Haven, Mich. (July '41) *M*

Thomas, Robert O., Asst. Hydr. Engr., State Div. of Water Resources, 401 Public Works Bldg., Sacramento, Calif. (Oct. '46) *PR*

Turner, E. S., Partner, William S. Turner & Co., Pacific Bldg., Portland 4, Ore. (Apr. '44) *P*

White, Lawrence S., 131 Kingswood Rd., Toronto 8, Ont., Can. (Jan. '43) *P*

Wright, Herbert W., Chemist, Filtration Plant, Metropolitan Dist. Water Bureau, 2 American Row, Hartford, Conn. (Jan. '47) *P*

CHANGES IN ADDRESS

Changes received between January 5 and February 5, 1950

Acevedo-Quintana, Francisco, A-C Instituto Nacional de Obras Sanitarias, Esq. Tienda Honda, Caracas, Venezuela (Jan. '41)

(Continued on page 36)

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(Continued from page 34)

Allen, E. Jerry, Asst. Supt., City Water Dept., 7517 Bagley Ave., Seattle 3, Wash. (Apr. '44) *MPR*

Arbuckle, Mortimer M., Chief Operator, Masterson Tex, Box 150, Channing, Tex. (Oct. '47) *P*

Bacon, Vinton W., 7550 Terrace Drive, El Cerrito, Calif. (Jan. '41) *MPR*

Baldwin Park County Water Dist., James B. Faris, 14521 E. Ramona Blvd., Baldwin Park, Calif. (Corp. M. July '43)

Barnes, George William, Supt., South Huntington Water Dist., W. 13th St. & 5th Ave., S., Huntington Station, N.Y. (Apr. '47)

Bartuska, James F., 1629 Cleveland Ave., Whiting, Ind. (Oct. '24) *MP*

Beenfeldt, Norman, Div. Mgr., California Water & Telephone Co., Box 1, National City, Calif. (Jan. '44) *MPR*

Binford, Thomas A., Engr., The Dorr Co., Inc., 945—5th Ave., Los Angeles 6, Calif. (Oct. '45) *P*

Blomquist, H. F., 1801—8th Ave., S.E., Cedar Rapids, Iowa (May '17) *Director '49–'50. MP*

Booth, George W., R.D., Glen Gardner, N.J. (Feb. '24) *Honorary M. '45. R*

Bowman, James W., Civ. Engr., 2948 Des Plaines Ave., Riverside, Ill. (Jan. '49)

Brewer, C. M., Gen. Mgr., Corona City Water Co., 707 Main St., Corona, Calif. (July '48)

Brinck, C. W., U.S. Public Health Service, 605 Red Cross Bldg., 417 E. 13th St., Kansas City 6, Mo. (Jan. '43) *PR*

Brisbane, Eugene C., Box 311, Beverly Hills, Calif. (Jan. '36)

Brooks, R. W., Dist. Mgr., Layne-Western Co., 53 W. Jackson Blvd., Chicago 3, Ill. (Oct. '46)

Brunton, Charles L., Supt., City Water Dept., 261 South St., Jackson, Ohio (July '35)

Burack, William D., Engr., 732 Northfield Ave., West Orange, N.J. (Jan. '36) *P*

Calderara, O. J., 123 N. Grant St., Hinsdale, Ill. (Oct. '40) *MPR*

Clouser, L. H., Wallace & Clouser, Cons. Engrs., Box 318, Knoxville, Tenn. (July '37) *PR*

Collins, R. E., Box 914, Donna, Tex. (Jan. '44) *MP*

Cook, Paul D., City Mgr., City Hall, Painesville, Ohio (Mar. '34) *Fuller Award '48. MP*

Cook, Will W., Sales Engr., Proportioneers, Inc., 501 Maritime Bldg., Seattle, Wash. (Apr. '38) *PR*

Crow, William B., Black Labs., Inc., 968 S. Oak St., Gainesville, Fla. (July '47)

DeHoff, Ronald L., Tech. Director, Southwestern Chemical Eng. Co., 1302–4 Marilla St., Dallas, Tex. (Apr. '49) *P*

Doll, Byron E., 351 Bonhill Rd., Los Angeles 49, Calif. (July '39) *MP*

Dowdell, P. H., Mgr., Butler Water Co., 120 E. Cunningham St., Butler, Pa. (Jan. '41) *M*

Egan, Joseph H., Crane Co., 7000 Oakwood Ave., Los Angeles 36, Calif. (Oct. '31) *M*

Eyer, Chet, Supt. of Distr., Water Dept., Box 958, Billings, Mont. (Apr. '47) *P*

Fiesler, Frederick A., 145 E. High St., Edwardsville, Ill. (Jan. '44) *MP*

Fisher, L. M., American Public Health Assn., Box 117, Garrett Park, Md. (July '35) *PR*

Fleet, Gerald A., American Well Works, 475—5th Ave., New York 17, N.Y. (Jan. '46) *P*

Fraser, Sam D., Mgr., Del Mar Water, Light & Power Co., Box 256, Del Mar, Calif. (May '26) *MP*

Friedley, John, Supt. of Water, Town of Clarence, 116 Wildwood Drive, Williamsville 21, N.Y. (Apr. '47) *M*

Fuller, A. Kenneth, Dist. Mgr., California Water & Telephone Co., 1133 Loma Ave., Coronado, Calif. (July '38) *M*

Fulmer, Frank E., R.R. 2, Mishawaka, Ind. (Apr. '47)

General Elec. Co., Plant Tech. Library, Richland, Wash. (Corp. M. Jan. '48)

Georgia, Ellis G., Maj., APO 331, c/o Postmaster, San Francisco, Calif. (Jan. '49)

Goble, Harry W., Water Clerk, Township of Parsippany-Troy Hills, R.R. 1, Box 89, Parsippany, N.J. (Jan. '49)

Gray, E. W., 404 Frick Bldg., Pittsburgh 19, Pa. (Apr. '44)

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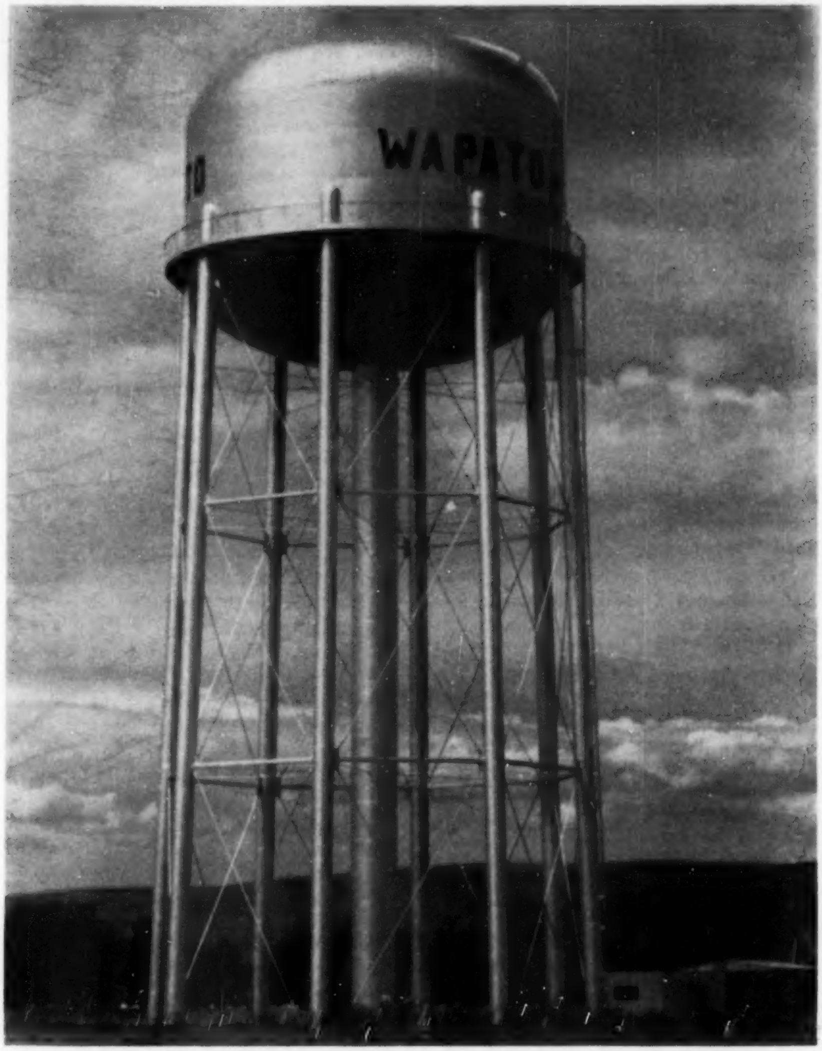

Horton Elevated Tank at Wapato

This 500,000-gal. Horton welded elevated steel tank was installed in the Wapato, Wash., water system to provide a supply of gravity water to improve pressure in the mains throughout the water distribution system. It is 94 ft. 6 in. to bottom.

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(*Continued from page 36*)

Griggs, Marion A., Chief Pumping Plant Operator, McNary Dam Site, Corps of Engrs., Box 442, McNary, Ore. (Apr. '49) *MP*

Henson, James O., Jr., 2358 Minto St., Augusta, Ga. (Jan. '48)

Hickok, Sidney J., Water Supt., Katonah, N.Y. (Oct. '43) *M*

Holloway, Arthur H., Jr., c/o American Consulate, Belem, Para, Brazil (Oct. '46)

Holmgren, Richard S., Asst. Chief Engr., San Diego County Water Authority, 235 Broadway, San Diego 1, Calif. (July '47) *M*

Indiana Dept. of Conservation, C. H. Bechert, Director, Div. of Water Resources, 311 W. Washington St., Indianapolis 9, Ind. (Corp. M. Jan. '38) *R*

Inspiration Cons. Copper Co., Charles B. Kettering, Leaching Plant Supt., Box 189, Inspiration, Ariz. (Corp. M. Jan. '47)

Kappe, Stanley E., Kappe & Assoc., 5200 Wisconsin Ave., N.W., Washington 15, D.C. (Apr. '32) *P*

Karpen, Raymond J., Lt. Col., 613—22nd St., N.W., Washington, D.C. (Jan. '46) *P*

Kaufman, Warren J., 603B Graduate House, Massachusetts Inst. of Technology, Cambridge 39, Mass. (July '47) *MP*

King, J. S., Mgr., Cincinnati Branch, Fairbanks, Morse & Co., 49 Central Ave., Cincinnati 2, Ohio (Jan. '49)

King, Kenneth K., Director of Public Works, Phoenix, Ariz. (July '40) *M*

Kircher, A. M., 302½ N. Front, Mankato, Minn. (Oct. '39) *MP*

Kittrell, Francis W., Tennessee Valley Authority, 640 New Sprankle Bldg., Knoxville, Tenn. (July '35) *R*

Klaer, Fred Harlen, Jr., Geologist, U.S. Geological Survey, 311 W. Washington St., Indianapolis 9, Ind. (Oct. '43) *R*

Knight, G. Webber, 927—15th St., N.W., Carry Bldg., Washington, D.C. (Dec. '25) *M*

Lapworth, Charles Frank, 25 Victoria St., London S.W. 1, England (July '45)

Leary, George K., Water Works Service Co., Inc., 14½ N. 10th St., Richmond, Ind. (Jan. '46)

Lee, W. Howard, Lee Eng. Service, 61 Broadway, Denville, N.J. (Oct. '40)

Lee, W. Howard, Lee Eng. Service, 61 Broadway, Denville, N.J. (Oct. '40)

Liberman, J. A., 1016 Jod St., Falls Church, Va. (Apr. '47)

MacPherson, William, Consultant, Ledesma Hotel, Iloilo City, P.I. (July '49) *MP*

Marsh, Francis B., 76 Davis Ave., White Plains, N.Y. (May '24) *MP*

McIntyre, F. J., Director, Columbus Water & Chemical Testing Lab., 4628 Indianola Ave., Columbus 2, Ohio (July '39) *P*

Mead, Zerald L., Mgr., Public Utilities, 304 N. Huron St., Ypsilanti, Mich. (July '46) *MPR*

Medbery, H. Christopher, Engr. of Water Purif., Water Dept., 425 Mason St., San Francisco 2, Calif. (Oct. '37) *P*

Merryfield, Fred, Route 2, Corvallis, Ore. (May '34) *Fuller Award '44.* *P*

Morrison, John H., Pres. & Chief Engr., Morrison-Maierle, Inc., Civic Center, Helena, Mont. (Jan. '46) *MP*

Muckenfuss, Charles H., Supt., Public Works Com., Box 322, Aiken, S.C. (Apr. '46) *M*

Murray, Walter, Engr., 6837 Somerled Ave., Montreal, Que. (Jan. '48) *MPR*

Natural Gas Equipment, Inc., S. Kenneth Weiser, 190 E. Glemarm St., Pasadena 2, Calif. (Assoc. *M.* July '48)

Nevius, F. C., Dist. Mgr., Turbine Equipment Co., 154 East Ave., Rochester 4, N.Y. (Oct. '46)

Novaro, Joseph A., New Haven Water Co., 100 Crown St., New Haven, Conn. (Jan. '47) *MP*

O'Connor, Philip J., Supervisor of Filtration & Chief Chemist, Water Purif. Plant, 508 Summit St., N.W., Warren, Ohio (Feb. '22) *MP*

Olson, Oscar A., Engr., Mercer Island Cooperative Water Assn., 2222—78th Ave., S.E., Mercer Island, Wash. (Apr. '44) *M*

Oswalt, W. H., City Mgr., City Bldg., Midland, Tex. (Jan. '49)

Phelps, Boyd E., Pres., Boyd E. Phelps, Inc., 1000 Washington St., Michigan City, Ind. (Oct. '46)

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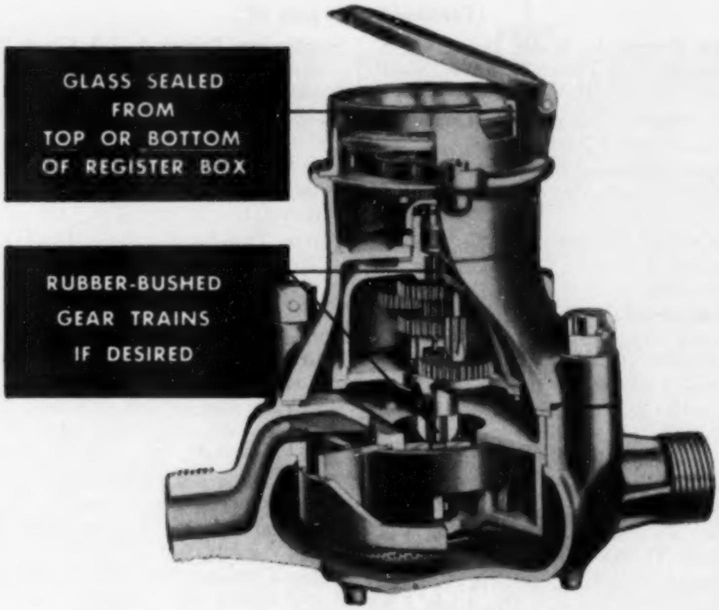

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Philips, Everett A., Water Dept., 450 S. Alameda East Drive, Compton, Calif. (Apr. '47) *MPR*

Pizie, Stuart, Chamber of Commerce Bldg., Miami, Fla. (Oct. '42)

Plummer, Raymond B., Francis Eng. Co., 300 S. Goodwin, Urbana, Ill. (Oct. '43) *P*

Ponte Valery, Antonio, Civ. Engr., Este 6, No. 217, El Conde, Caracas, Venezuela (Oct. '48)

Radhakrishnan, S., S.O.R.I.E., Engr.-in-Chief's Branch, Army Headquarters, New Delhi, India (Oct. '48)

Ramirez, Conrado S., 1000-B Florentino Corner, Craig St., Sampaloc, Manila, P.I. (Jan. '47) *PR*

Rees, Rhea, 1700 W. 20th St., Sioux Falls, S.D. (Jan. '39) *MPR*

Refinite Corp., The, C. A. Spaulding Jr., Gen. Mgr., Box 1201, Omaha, Neb. (Assoc. M. Apr. '32)

Rice, John M., Cons. Engr., 412 Columbia Bldg., Pittsburgh 22, Pa. (June '21) *MPR*

Riley, Harley M., Regional Engr., State Dept. of Health, 311 State St., Albany 6, N.Y. (Apr. '46) *P*

Ritter, Roy H., 606 Chester Ave., Towson 4, Md. (July '43) *P*

Robinson, Thomas B., Cons. Engr., 4016 W. 67th Terrace, Mission, Kan. (Jan. '48) *MPR*

Roby, Richard E., Asst. Supt. of Filtration, Passaic Valley Water Com., Little Falls, N.J. (Jan. '41)

Rome, Robert, 5891 Alma Rd., Vancouver, B.C. (Dec. '30)

Shipley, Charles G., Plant Supt., R.F.D. 9, Box 222, Naval Base, S.C. (Apr. '49)

Shonerd, R. E., Chief Mech. Engr., 404 County Eng. Bldg., Los Angeles 12, Calif. (June '28)

Shull, Albert B., 14701 S. Hagar St., San Fernando, Calif. (Apr. '33) *P*

Sieveka, Ernest H., Center Junction, Iowa (Apr. '42)

Silver City Water Dept., Rowland Ball, Supt., Box 1188, Silver City, N.M. (Corp. M. Oct. '41)

Smithson, Thomas, Cons. & Design San. Engr., 555 S. Cedar Hills Blvd., Beaverton, Ore. (Apr. '40) *MPR*

Sparling, Ray C., 809 S. San Fernando Blvd., Burbank, Calif. (Oct. '39) *P*

Stephenson, Robert J., Elk Creek Water Works Engr., 116 Young St., N., Chilliwack, B.C. (Jan. '45) *MP*

Stewart, Spencer D., Proprietor & Mgr., Consolidated Water Co., 4116 N. 23rd Ave., Phoenix, Ariz. (July '47)

Strang, John A., 2558 McGee Trafficway, Kansas City 8, Mo. (Feb. '23) *P*

Stuart, Charles L., Mgr., Long Island Plants, New York Water Service Corp., 60 Glen St., Glen Cove, N.Y. (Jan. '40) *M*

Stufflebean, John H., Chief Assoc. Engr., Blanton & Cole, 155 W. Pennington, Tucson, Ariz. (July '48)

Sussman, Sidney, Water Service Labs., 423 W. 106th St., New York 27, N.Y. (Jan. '45) *P*

Thomas, David S., Dist. Engr., Board of Fire Underwriters of the Pacific, 205 Eklund Bldg., Great Falls, Mont. (Feb. '27) *Fuller Award '44.*

Tillman, Martin, Supt. of Filtration Plant, 160 Russell Drive, Antioch, Calif. (Oct. '43) *P*

Tomlinson, Walter John, Tech. Director, E. F. Drew & Co., Ltd., Ajax, Ont. (July '38) *P*

Van Der Lely, J., Weverskade 17, Maasland (Z.H.), Netherlands (Jan. '49)

Waddell, W. J., Western Repr., Neptune Meters, Ltd., 4202 Macleod Trail, Calgary, Alta. (Jan. '45)

Walton, Wilbur L., Water Softener Service Co., Inc., 231 S. LaSalle St., Chicago 4, Ill. (Oct. '45)

Wannoni, Luis L., Avenida Mohedano 80, Urbanizacion la Castellana, Caracas, Venezuela (Jan. '47) *M*

Watson, Kenneth S., Asst. Director, Ohio River Valley Water Sanitation Com., 414 Walnut St., Cincinnati, Ohio (Jan. '39)

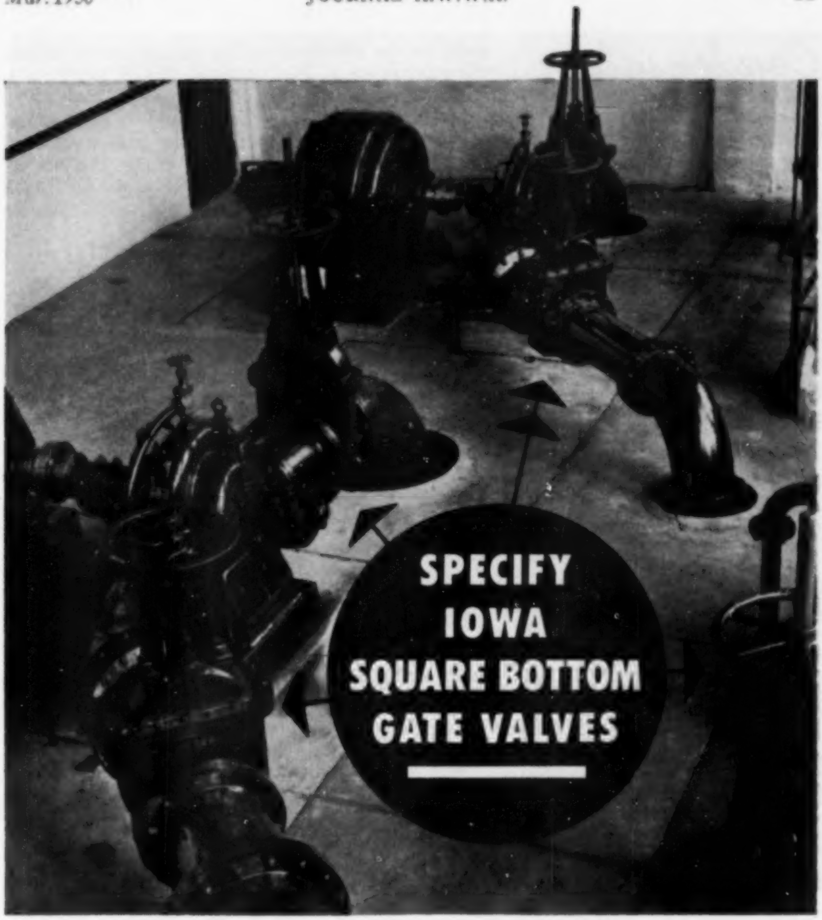
Whipple, George W., Supt. of Water, Le Roy, Ohio (Oct. '48)

Whipple, Melville C., 79 Larchwood Drive, Cambridge 38, Mass. (May '22) *P*

White, William W., Director, Div. of Public Health Eng., State Health Dept., 323 West St., Reno, Nev. (July '37) *P*

Will, Edgar G., 98 E. Tulane Rd., Columbus, Ohio (Jan. '46) *P*

Williams, William D., 1811 N. 1st Ave., Phoenix, Ariz. (Apr. '43)



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Key: In the reference to the publication in which the abstracted article appears, 39:473 (May '47) indicates volume 39, page 473, issue dated May 1947. If the publication is paged by the issue, 39:5:1 (May '47) indicates volume 39, number 5, page 1, issue dated May 1947. Abbreviations following an abstract indicate that it was taken, by permission, from one of the following periodicals: *B.H.—Bulletin of Hygiene* (*Great Britain*); *C. A.—Chemical Abstracts; I. M.—Institute of Metals* (*Great Britain*); *P.H.E.A.—Public Health Engineering Abstracts; S.W.J.—Sewage Works Journal; W.P.R.—Water Pollution Research* (*Great Britain*).

EUROPEAN SUPPLIES

Studies on Surface Water Treatment [Belgium]. M. A. VAN DE VLOED. Tech. l'Eau (Belg.) **3**:5 (Feb. '49). Due to political conditions only 11% of Flemish towns in Belgium served by regional or local water supplies, whereas 53% of Walloon section thus served. About 100 mgd. available from wells and another 265–530 mgd. must be obtained from surface waters. Surface waters pold., having coliform index varying from 80 to 6800; org. matter on settling varies from less than 60 to over 800 ppm. Coagulation with iron sulfate best at pH 5.5–6; with alum, at 6–6.5; other coagulants could not be used because of presence of bicarbonates in water forming insoluble hydrates. Filtration expts. show that finely divided org. matter present which could not be entirely removed.—*W. Rudolfs.*

Symposium on Water Pollution Caused by Industrial Wastes [France]. L'Eau (Fr.) **36**:63 (May '49). Problem of poln. of great legal, admin. and tech. importance. Law provides penalties (3 months in jail and 12,000 francs fine) but is considered ineffective. From admin. standpoint problem complex; difficult to bring fishery interests and industries together; decentralized labs. and expt. stations must be established. Symposium divided into 3 parts: [1] discussion of poln. in general, continuous and intermittent poln., chem. and org. poln., self-purif., action of pollutants on fish and fish food; [2] detection of poln., enumeration of precautionary measures, toxicity detns., effect of poln. on flora and fauna; [3] laws, civil and penal actions. Since methods of detecting poln. imperfect, especially in regard to toxicity of wastes, more work must be done.—*W. Rudolfs.*

Recovery of By-Products From Sewage Plants [France]. M. R. DUFOURNET. L'Eau (Fr.) **35**:3:29 (Feb. '48). Of 1500 French cities

(*Continued on page 44*)

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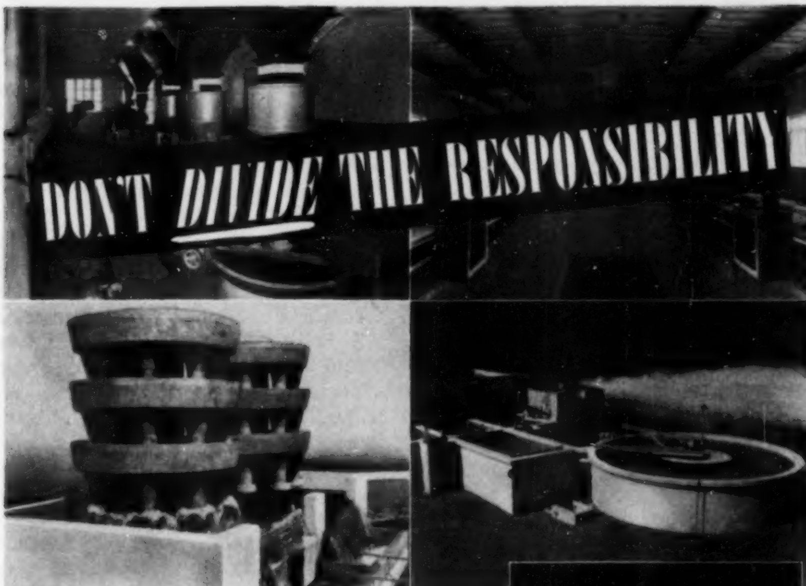

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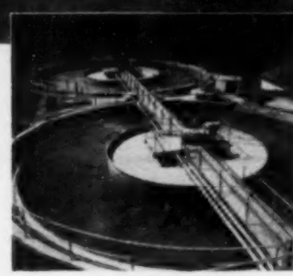

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(*Continued from page 42*)

with population over 3000, some 300 have more or less rudimentary sewerage systems, and less than 100 have sewage treatment plants. Consequently rivers heavily pold. and ground water supplies contaminated. On Jan. 1, 1948, total of 775 water works projects and 708 sewerage projects were proposed for war-damaged cities and 50 and 69 projects, respectively, for other cities. 321 approved for reconstruction. After 5-yr. study, commission concluded that no rapid progress could be made in sewage treatment unless certain by-products recovered, particularly effluent for irrigation, sludge for fertilizer and gas for municipal use.—*Willem Rudolfs.*

Program for a L'Ain County [France] Potable Water Supply. B. Tiersonnier & R. Janin. L'Eau (Fr.) **36**:35 (Mar. '49). The Department (county) of Ain covers about 5800 km. and Ain R. traverses county in center from north to south. 450 communities have total population of 315,000, and approximately 250,000 people live in rural areas. About 280 communities have some kind of water supply or distr. system, 176 have none. Of 280 communities theoretically supplied with water, most are in development stage or have insufficient supply; nearly all water contamd., even more important systems distributing water with coliform index of 50–500. Unpold. and sufficient water rare. Surveys have shown local ground water supplies generally small and cannot be developed sufficiently for munic. supplies. Surface water available, but requires reservoirs and treatment plants. Essential diffi-

(*Continued on page 46*)

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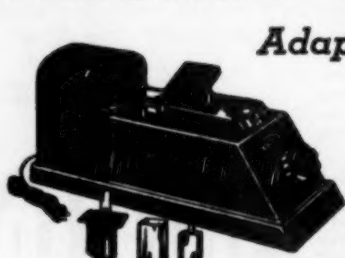

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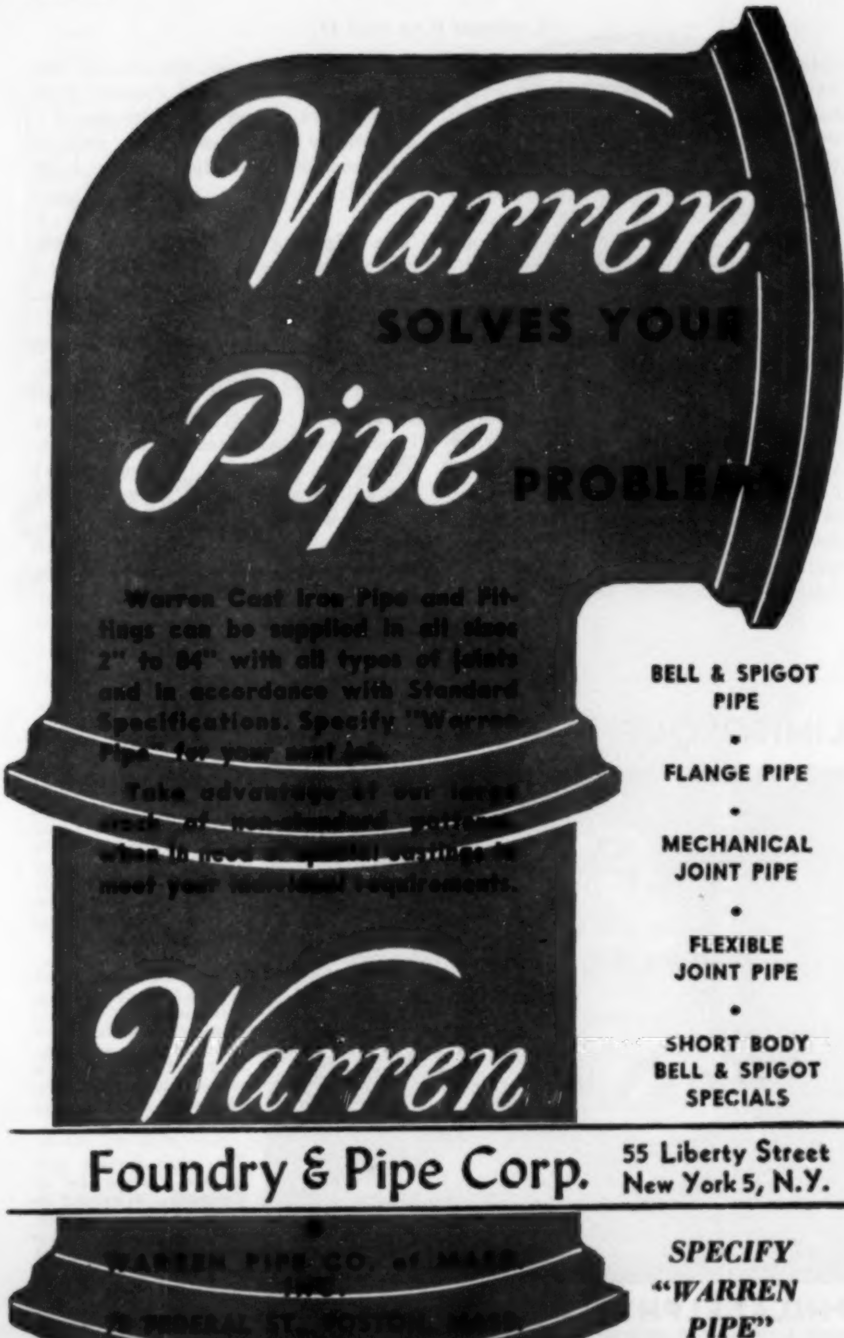
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(*Continued from page 44*)

culties: costs (75,000 francs per inhabitant); political restrictions, which make credit applications for public works difficult; great variety of problems difficult to solve by private enterprise. Program adopted to extend laws, charge 50% of cost to collective enterprises and grant state aid. Work estd. to cost 80,000,000 francs.—*W. Rudolfs.*

Treatment of Water in Dinard Region [France] by the Fremur Plant. M. J. Arraudeau. L'Eau (Fr.) **36**:51 (Apr. '49). Raw water stored in 500,000-cu.m. reservoir, turbid (250–400 ppm.), brown colored, with pH of 6.7. On storage pH increase to 7.1–7.2 caused by CO_2 absorbing flora. This peculiarity permits effective liming before addn. of alum. After aeration water settled for 2 hr. in rectangular tanks, flocculated, lime added and filtered on 8 circular rapid sand filters (sand effective size 0.7; uniformity coefficient, 1.6), chlorinated and sent into distr. system.—*W. Rudolfs.*

The Meeting of Water and Sewage Specialists in Wiesbaden [Ger.], (Sept. 16, 1947). Wilhelm Merkel. Gas- u. Wasser. (Ger.) **89**:1:13 ('48). Report on first postwar meeting in western Germany. Problems discussed were: Water supplies as part of water economy. Work of hydrologic survey for Hessen, which combines geologic and hydrologic work through inventories of water-bearing strata, springs, water supplies, rainfall, ground water levels, as well as chemical and bacteriological data. Problem of relation of regional chemi-

(*Continued on page 48*)

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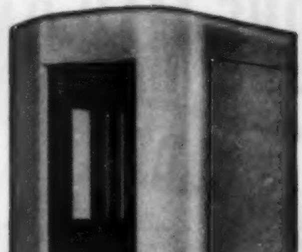

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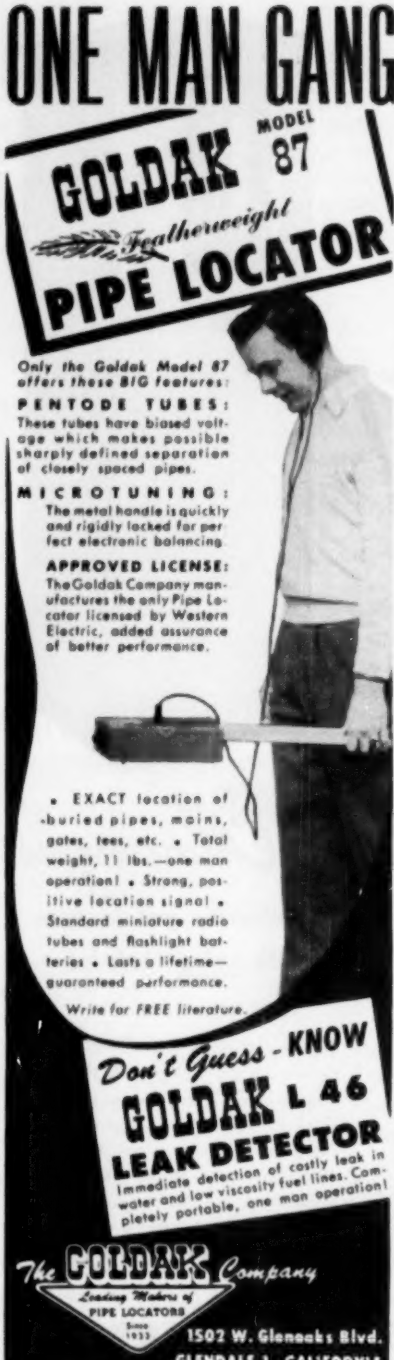

(Continued from page 46)

cal anal. of ground water to hygienic indication of single anal. based on mapping of 1 ground water anal. per 2 sq.mi. and showed that chlorides, ammonia, nitrates and permanganate oxidation indicated zones of fairly uniform content for each aquifer and that pollution could only be indicated if single anal. showed great variation within zone. Experiences in well construction discussed—clay-tile and wooden screens, gravel packing, calculation of highest yield from effective size and incrustation of screens. Enlargement of water works for Wiesbaden described. One paper dealt with properties of mixed-in-place concrete and its use in reservoirs and channels. New chlorination process, Timmermann process, described, in which fresh solution water under pressure passes through series of nozzles into reaction chamber, into which chlorine and air also introduced. Claimed that thereby no chlorides are formed, but only new, stable, oxygen-splitting chlorine compounds; mixed solution water does not have chlorine, but aromatic odor and taste and does not corrode iron. Requirements for fresh solution water are that it be clear, free of iron and manganese, have low oxygen demand and contain no free chlorine. Fairly satisfactory results with this system of chlorination are described from Frankfurt-am-Main. Some claims made for this apparatus contradicted in discussion, and it is brought out that study needed of fundamental processes taking place during chlorination.—*Max Suter.*

Water Supply in Relation to Water Economics [Ger.]. R. SCHEMEL. Gas- u. Wasser. (Ger.), **88**:153 ('47). Author discusses importance of choosing as source of water supply raw water of good qual. and describes difficulties caused in German industrial dists. by density of pop. and

(Continued on page 50)

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(Continued from page 48)

rapid growth of industry. Improvements effected by various river boards briefly summarized, and importance emphasized of control of both sewage and water works by state authorities, who alone have power to implement recommendations of river boards. Author then stresses importance of planning and controlling development of industry and distr. of pop.—*W.P.R.*

Studies and Planning in the Fields of Water Supply and Sewerage [Poland]. Jozef Liebfeld. Gaz, Woda i Tech. Sanit. (Poland) **23**:187 (June '49). Success of 6-yr. plan for industrialization dependent on possibility of supplying required quants. of water for industry as well as labor. Increase in number of municipal water supply and sewerage installations in Poland as follows: water supply—111 in '18, 197 in '39, 361 in '49; sewerage—74 in '18, 152 in '39, 315 in '49. Magnitude of undertaking may be appreciated when remembered that many of these installations suffered war damage and many others must be extended. [Much of increase noted for period '39–'49 due to number of installations found in former German territories assigned to Poland after World War II in lieu of territories ceded to Russia in eastern Poland.] Author lists water supply and sewerage systems in cities in each of the provinces. Of 702 cities, 361 have water supplies and 315 sewerage systems. Therefore, 341 municipalities lack water supplies and 387 lack sewerage systems. Of cities having pop. in excess of 10,000, 29 without water supplies or sewerage systems. To above must be added cost of providing rural areas with water and possible removal and agricultural utilization of sewage. Total cost of all projects deemed necessary amounts to approx. $460,000,000. Program to extend over 50-yr. period at annual expenditure of approx. $9,200,000. In 3-yr. program ('47–'49) major emphasis on rehabilitation of war-damaged plants. Approx. $4,000,000 spent. For period '50–'55 approx. $47,500,000 allocated for extension of water and sewerage works and construction of new works. Author cites various govtl. decrees concerned with water supply and sewerage and lists various agencies involved and their respective interests in these fields.—*Conrad P. Straub.*

The Development of the Problem of Protecting Surface Waters From Pollution in Poland. Zygmunt Rudolf. Gaz, Woda i Tech. Sanit. (Poland) **23**:191 (June '49). Author traces history and development of program for protection of Polish surface waters from contamination. In '30

(Continued on page 52)

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(*Continued from page 50*)

intercabinet committee appointed which set up laws and procedures for controlling pollution. This group and its successors suggested following program: [1] detn. of present pollutional state of rivers, [2] preparation of maps showing points of industrial waste discharge on watersheds considered, [3] classification of streams to indicate degrees of pollution and [4] establishing standards of treatment for wastes, depending upon receiving stream. These commissions were aided by staff of experts and by 3 experimental stations. During World War II these activities ceased, but again activated after war. Author proposes two motions for consideration by professional groups concerned: that a legislatively regulated body be set up to consider problem of pollution and that central institution be advocated closely linked with Dept. of San. Eng. Constr. in Warsaw Polytechnical School for carrying out research studies in this field.—*Conrad P. Straub.*

Protection of Areas Around Water Sources [Poland]. Jozef Stiksa. Gaz, Woda i Tech. Sanit. (Poland) 22:316 (Oct. '48). Examples given of loss of flow at 2 Czechoslovakian spas (having mineral spring water sources) due to mining operations 5–10 mi. from these resorts. Several Polish spas described and notation made that no yield data available. Suggestion made that not only sources of springs be protected from local contamination, but that yield itself be protected. Two areas of protection indicated: one close to actual source to protect it from contamination; other, of much greater magnitude, to

(*Continued on page 54*)

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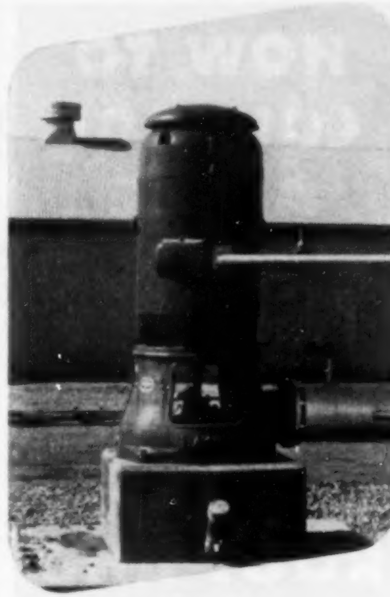

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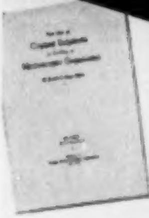

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(Continued from page 52)

protect yield (depending upon hydrographic and geological study of area). Yield data, to be of value, should cover period of at least 10 yr. to reduce range of variation to approx. ±20% of mean value.—*Conrad P. Straub.*

Development of Water and Sewerage Construction in Lodz [Poland] Under the Six-Year Plan. Mieczyslaw Badziak. Gaz. Woda i Tech. Sanit. (Poland) **23**:179 (June '49). Present source of water (deep wells) will provide 4.75 mgd., whereas 39.6 mgd. required for Lodz. At max. development, present source will supply 9.25 mgd., about 23% of amount needed. Distr. system, concd. in center of city, is 44.8 mi. long and covers 4% of city area. At present 970 bldgs., including pop. of 100,000, connected to distr. system. Industrial usage now totals 0.8–1.05 mgd., but needs estd. at 21.1 mgd. Ground water supply extremely critical, since it is reported that water level lowered 49.2′ in Lodz area since 1931. As possible source of supply, consideration being given to Pilicy R., which has min. flow of 317 mgd., averaging 845 mgd. This source could easily supply 39.6 mgd. required for Lodz and surrounding communities. This volume of water will satisfy needs of pop. of 1,000,000. Of 39.6 mgd. to be provided, 21.1 for industrial purposes, leaving approx. 18.5 gpd./cap. for domestic use. In addition to above, industry will continue using present well sources. Some water will be taken from well fields, each of which will include iron removal units, and remainder will be taken from Pilicy R. These waters will be settled and filtered and pumped into 3 mains, each approx. 30 mi. in length. Two mains will be approx. 32″ in diam., and remaining one approx. 40″. 4 equalizing reservoirs will be located at Lodz with storage capac. of 31.7

(Continued on page 56)

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(*Continued from page 54*)

mil.gal. These will feed distr. system by gravity. Approx. 372 mi. of distr. system will have to be constructed at cost of $31,000,000 with addnl. $3,-350,000 for house connections. Program will be constructed in stages. 6-yr. plan calls for supplying sufficient water for 500,000 pop. and for approx. 4 mgd. for industry. First stage calls for development of ground water source of 10.6 mgd. at Pilicy R. site, construction of 32"-diam. pipeline, and increase in yield of existing wells to 7.3 mgd. This would give total supply of 17.9 mgd. Completion expected by 1955, including constr. of iron removal plant and necessary pumping stations. Cost to be $9,-090,000, of which $6,850,000 for source, treatment and storage facilities and $2,240,000 for expansion of distr. system. Consideration also given disposal of sewage in 6-yr. plan. Approx. 62.2 mi. of sewers now serving 2850 homes with pop. of approx. 200,000. 6-yr. plan calls for extension of sewer lines to 155 mi. and construction of treatment plant at cost of $5,600,000. Total cost of 6-yr. plan will be approx. $14,730,000. Data presented on material and personnel requirements.—*Conrad P. Straub.*

The Use of the Filter Plant of the City of Lausanne [Switzerland] for Intensive Culture of Fish. CHARLES BECHERT. Monatsbulletin (Swiss) p. 54 (Mar. '48). Normal hatcheries require much space, water and labor. Intensive fish culture can be obtained in small space by maintaining, under trained supervision, better conditions of life. This done by careful regulation of water and food supply, latter

(*Continued on page 60*)

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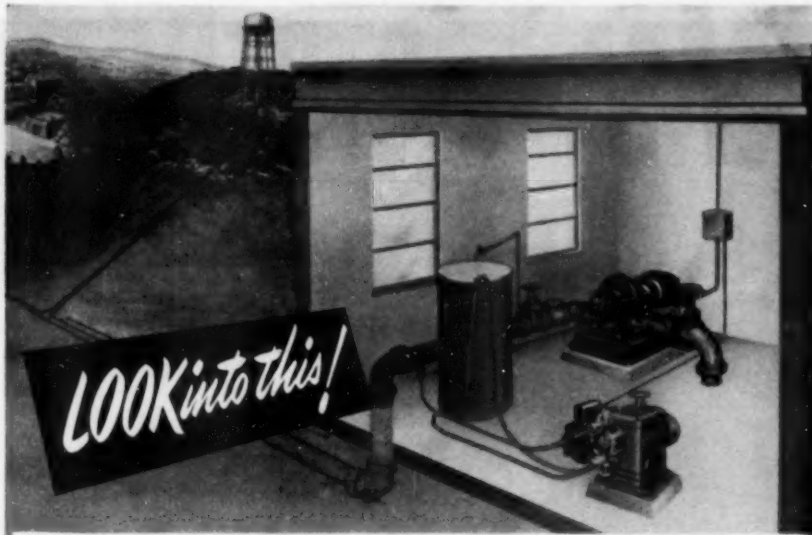

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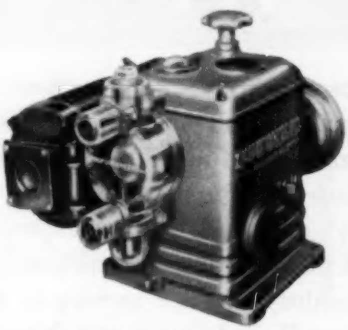

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(*Continued from page 56*)

being increased by use of traveling suction device over top of filter. Type of fish to be raised depends on conditions of raw water and its plankton. In Lausanne, it was possible to raise 120,000 fish (salmon trout, graylings, trout and pike) per year in plant having filter capacity of 6 mgd. (Of course this system cannot be used in plants where coagulation or softening precedes filtration.)—*Max Suter.*

WELLS AND GROUND WATER

Explosive Charges in Water Supply Boreholes. G. R. S. STOW. Wtr. & Wtr. Eng. (Gt. Br.) **52**:408 (Aug. '49). Well known that yields of boreholes can be greatly increased by acidizing or shot firing; inclined borings can be drilled from sides of main boring to increase yield; and borehole casings can be perforated *in situ* by underwater gas cutters, mechanical perforators, or slotters or gun type perforators. Now possible to achieve these objectives by use of small, specially shaped explosive charges, more effective than mass charges of possibly 10 times weight. Can be used safely without damage to bldgs. or machinery overhead. Charge should be designed for each particular operation to decide weight of explosive, dimensions of container, appropriate air-filled standoff dimensions, and method of lowering, aiming and firing.—*H. E. Babbitt.*

Tube Well Borings With Unreinforced Concrete Pipes. RAMESHWAR SARAN. Civ. Eng. (Gt. Br.) **43**:240 (May '48). Wrought-iron pipes of large diam. were either not available

(*Continued on page 62*)

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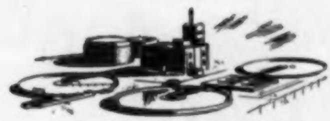

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(*Continued from page 60*)

or prices were prohibitive. Suitable design was developed for 18″-diam. unreinforced concrete pipes manufactured in 4′ lengths. Exptl. trial boring to 80′ depth with these pipes proved successful. Pipes 18″ id. and 23″ od., manufactured with forms working on spinning machine. Cast-iron cutting shoe attached to bottom of first pipe. Pit dug to depth of 8′ from ground level. Cutting shoe placed in center of pit. Pipe lowered into pit with tongue end resting on cutting shoe. Care taken that first three pipes perfectly plumb and that long vertical grooves (in sides) in straight line, so that iron bars running from shoe fit into them. At top of third pipe, steel ring placed in notch so that 3 bolts pass into holes in this ring. Iron clamp then fitted to top pipe, and whole is loaded with sand-bags. Boring started with sand pump pouring sufficient water from outside into pipe. When 3rd pipe sunk to 4′ from ground level, 4th pipe lowered in way described above with tongue end resting in groove of 3rd pipe. Boring thus continued to desired depth.—*H. E. Babbitt.*

Shaft Tunnels for Borehole and Well Pumps. ANON. Wtr. & Wtr. Eng. (Gt. Br.) **51**:361 (Aug. '48). Transmission shaft from motor at surface to pump hundreds of feet below surface will need number of bearings and lubrication. Risk of contaminating water with oil and fact that it is possible to use water-lubricated bearings makes latter practice preferable. Shaft tunnel becomes unnecessary if possible to forecast that water to be pumped is free from abrasive solids. Unfortunately, freedom from sand can seldom be absolutely guaranteed. Advantages of shaft tunnels for borehole pump: [1] protection of bearings against abrasive solids; [2] bearings may be flooded by external means before

(*Continued on page 64*)

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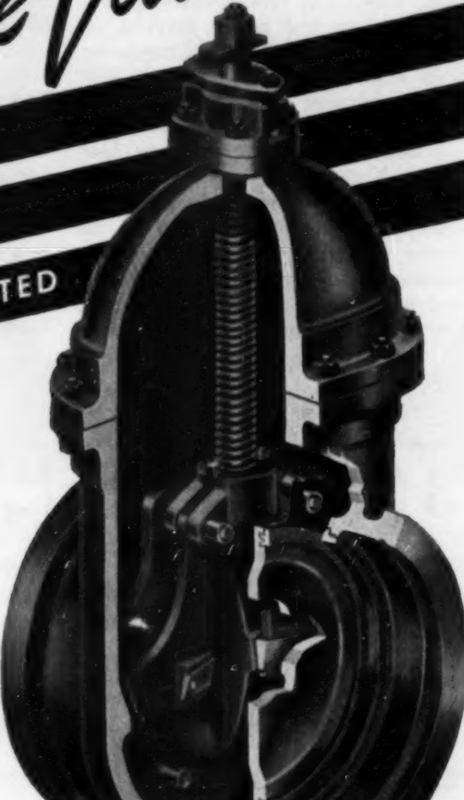

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(Continued from page 62)

starting up. Disadvantages: [1] initial cost; [2] complication in assembly. When pump installed without shaft tunnel and static level of water considerable distance below surface, number of bearings will be liable to run "dry" for short period after starting. Obviously foot valve should be fitted which will retain water in suspension main and assure flooding of bearings at all times. If suspension main remains full of water, it will add considerably to amount of water to be lifted when dismantling unit, unless dewatering device fitted to foot valve. Necessary to force clean water into shaft tunnel at pressure to overcome friction losses and be in excess of pump delivery pressure. Additional pressure normally generated by separate motor-driven pump. Use of separate pump can be obviated where considerable head is external to borehole and main pump can be divided into number of stages in borehole and additional stages at surface. Where pump stages essential to bring water to surface into treatment tanks and separate pump required to deliver treated water into mains, shaft tunnel filters become unnecessary, mains water being clean enough and at sufficient pressure to be utilized for lubrication purposes. Bearing material of greatest importance and may influence decision to fit or not to fit shaft tunnels. Metal bearings have been used, but most favored material for water-lubricated bearings has been lignum vitae, easily damaged by sand and subject to swelling or growth when submerged. Some plastics have given good results and appear to be less liable than lignum vitae to damage by

(Continued on page 66)

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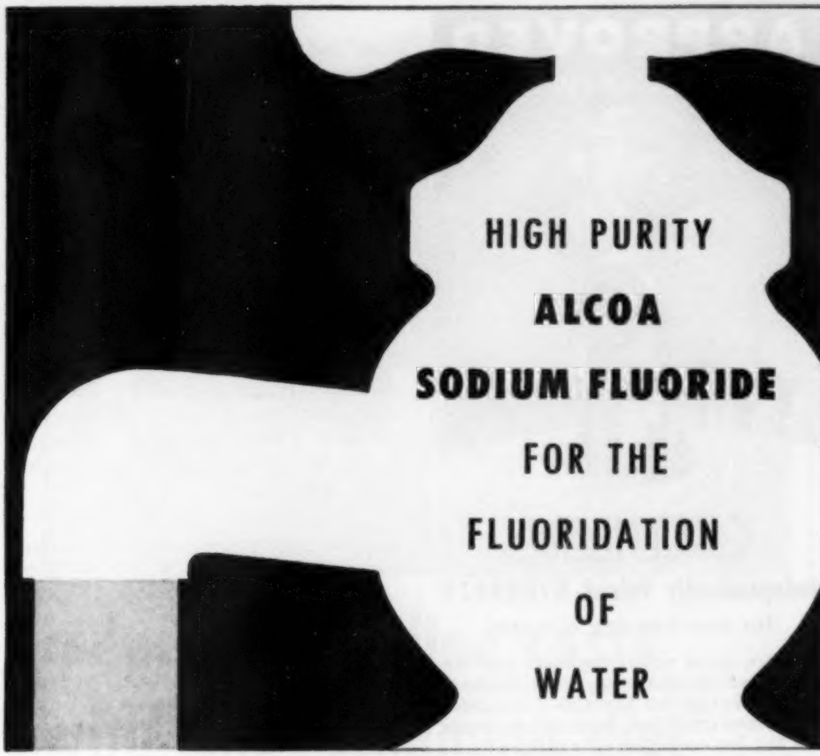

ALCOA Sodium Fluoride, like all other Alcoa Chemicals, has a uniform high degree of purity. It may be used with confidence for the fluoridation of water supplies. ALCOA Sodium Fluoride flows freely . . . is easy to handle . . . dissolves at a uniform rate. Besides that, ALCOA is a *dependable* source of supply.

If your community is fluoridating its water supply—or is considering doing so—let us discuss with you the properties of ALCOA Sodium Fluoride that make it particularly suitable for your use. Write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 624 Gulf Bldg., Pittsburgh 19, Pennsylvania.

Alcoa Chemicals

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ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

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GREENBERG
Independently Valved HYDRANTS
for non-freezing climates

Western water works engineers and fire chiefs were the first to approve Greenberg California-type fire hydrants. Now, after exhaustive tests, Underwriters' Laboratories, Inc. has confirmed your judgment.

Greenberg No. 74 and 76 hydrants are equipped with independent valves of a new type which open quickly and easily, allowing full flow with minimum resistance. They close tightly without water hammer. A major improvement over the old "cork in bottle" type valve!

Other innovations such as you would expect of the people who evolved the California-type hydrant 75 years ago are shown in the free booklet "Hydrants by Greenberg." May we send you a copy?

STABILITY *since* 1854

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El Paso • New York • Hartford • Washington, D.C.

(Continued from page 64)

sand and also have smaller growth coefficient.—*H. E. Babbitt.*

OTHER ARTICLES NOTED

Recent articles of interest, appearing in American periodicals, not abstracted, are listed below.

Safe Handling of Fluorine Chemicals. H. C. MILLER. Chem. & Eng. News, **27**:52:3854 (Dec. 26, '49).

Studies of the Action of Sodium Fluoride on Human Enamel by Electron Microscopy and Electron Diffraction. DAVID B. SCOTT, ROBERT G. PICARD & RALPH W. G. WYCKOFF. Pub. Health Repts., **65**:2:43 (Jan. 13, '50).

How to Take Fluoride Out of Water. ANON. Eng. News-Rec., **144**:3:40 (Jan. 19, '50).

Effect of Chlorine on Cation Exchange Resins. D. G. BRAITHWAITE, J. S. D'AMICO & M. T. THOMPSON. Ind. Eng. Chem., **42**:2:312 (Feb. '50).

Densities and Boiling Points of Sea Water Concentrates. CLIFFORD A. HAMPEL. Ind. Eng. Chem., **42**:2:383 (Feb. '50).

Controlling Water Hammer and Pipeline Surges. JOHN H. DAWSON. Pub. Wks., **81**:1:31 (Jan. '50).

Delaware Aqueduct Metering and Control Equipment Incorporates Many New Features. WALTER J. GRESS. Civ. Eng., **20**:1:37 (Jan. '50).

Round Table Discussion on the Need for Standards for the Inspection of Waterborne Industrial Wastes. Introduction. A.S.T.M. Bul. No. 162 (Dec. '49).

Acidizing Techniques for Water Wells. M. M. DEWITT. Wtr. Well J., **3**:6:11 (Nov.–Dec. '49).

reduce water line costs with this "slimming diet"

Excess weight and material in a water line is expensive and unnecessary. With Armco Welded Steel Pipe, you choose the exact wall thickness you need ($\frac{9}{64}$- to $\frac{1}{2}$-inch) in any diameter (6 to 36 inches). You save money and metal.

Armco Steel Pipe saves on installation, too. Lighter weight simplifies handling. Lengths up to 50 feet mean fewer joints—less assembly work. Field connections go in fast with any of the standard couplings or by field welding.

You'll also find that Armco Welded Steel Pipe is amply strong, free from leakage and provides continued high flow capacity. Use it with confidence wherever you need water supply or force mains. Write for complete data. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 3580 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation.

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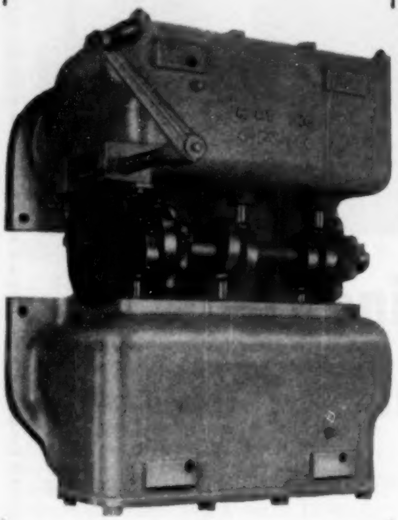
SOFT WATER?

Yes—but

When you buy any zeolite water softener—manual, semi-automatic or fully automatic—insist that it be equipped with an H & T poppet type multiport valve.



This valve, built in all sizes and for all requirements, is a masterpiece of workmanship and operating simplicity. It is available only to experienced water softener manufacturers.

Designed, built and guaranteed by

HUNGERFORD & TERRY, INC.

Clayton, New Jersey

Service Lines

An "Installation Guide—Transite Pressure Pipe" has just been published by Johns-Manville, 22 East 40th St., New York 16, N. Y. The 116-page, pocket-size manual covers the installation of the pipe from receiving and handling through pressure and leakage test to backfilling and tamping. Numerous drawings make the procedure clear and distinguish right from wrong methods. Fully indexed, and obtainable for the asking.

Deaerating heaters for treating boiler feedwater are shown in a bulletin produced by Graver Water Conditioning Co., 216 W. 14 St., New York 11. Both vertical and horizontal types are illustrated and their operation and design features explained.

Chlorinating equipment furnished by Fischer & Porter Co., 61 County Line Road, Hatboro, Pa., is the subject of an 8-page illustrated catalog No. 61, just issued. Entitled "Rato-Chlor Chlorine Dispensers" the booklet describes the workings of the units, which utilize a dry vacuum system with automatic shutdown upon vacuum failure. The capacity range is from 1 to 1,200 lb. chlorine daily in the self-contained cabinet type models, and unlimited in other noncabinet systems.

"Salt Water Infiltration and the Fisher M-Scope Water Well Tester" describes the contents of a booklet issued by Fisher Research Lab., Inc., Palo Alto, Calif. The equipment in question is an electrical conductivity apparatus for determining water level in a well, and also the extent of any salt water infiltration.

(Continued on page 70)

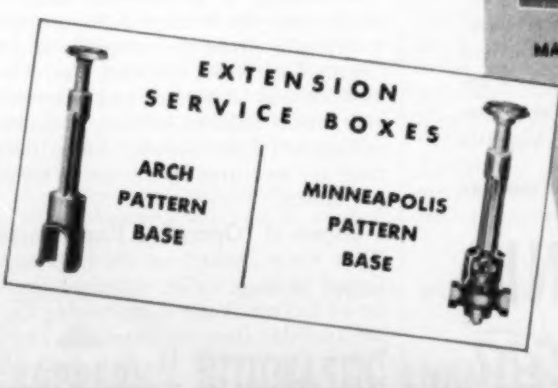
HAYS

WATER SERVICE PRODUCTS

for efficient maintenance

OVER 80 years of manufacturing experience . . . designed for easy installation . . . long years of trouble-free service . . . interchangeable with those of other manufacturers . . . corporation stops can be installed with any standard tapping machine.

All Hays fittings made of single, uniform, high quality water service bronze, 85-5-5-5 mix . . . hydrostatically tested at 200 pounds or more . . . plugs individually ground in for perfect fit . . . specially lubricated for permanent easy turning.



HAYS MANUFACTURING COMPANY

12TH & LIBERTY STREETS, ERIE, PENNA., U. S. A.

CONTROL RESIDUAL CHLORINE

CHLORINE is indispensable in the purifying of municipal water. Necessary, also, is the conditioning of this water for drinking purposes by the use of an effective antichlor, to make it more pleasant-tasting.

Superintendents and engineers of well managed plants make routine use of "Virginia" liquid Sulfur Dioxide ("Esotoo") in their filtering installations. They know, from experience, that "Esotoo" provides that accurate and positive control of residual chlorine which is so essential to palatable drinking water.

Our technical staff is at your service in solving this problem. Write to us for full information about "Esotoo" (SO_2) as a dechlor. Virginia Smelting Company, West Norfolk, Virginia.

50 YEARS OF SERVICE TO INDUSTRY

VIRGINIA

VIRGINIA

"Esotoo"

The preferred dechlor

WEST NORFOLK • NEW YORK • BOSTON • DETROIT

(Continued from page 68)

A descriptive circular on the "Jeep" holiday detector has been issued by Petroleum Instrument Co., P. O. Box 6252, Houston, Tex. The apparatus moves along the pipe and detects flaws in the external coating, sounding an alarm each time contact is made. The apparatus travels on roller bearings and can be used, with suitable electrodes, for any pipe size from 2 to 30 in.

Instrument transformers offered by Westinghouse Electric Corp. are the subject of a 12-p. booklet, B-4319, available from the company at P. O. Box 2099, Pittsburgh 30, Pa.

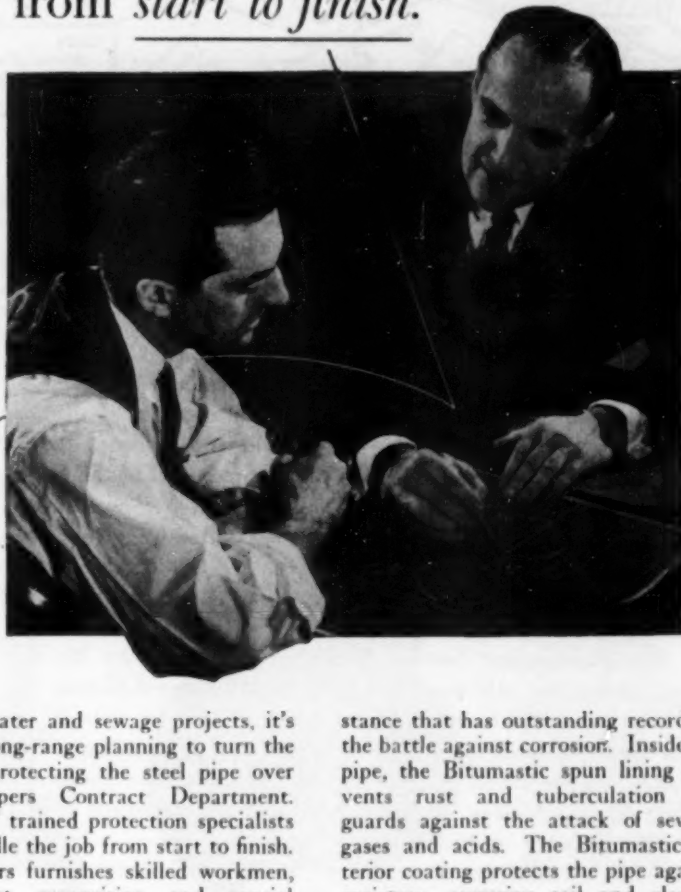
Aluminum posture chairs for more efficient office seating are described in a 22-page booklet released by Remington Rand, Inc. Copies may be obtained from the company at 315 Fourth Ave., New York 10, N.Y.

An ironized topping for concrete floors—said to outwear ordinary concrete surfaces and be spark and corrosion resistant, static disseminating, and easy to clean—is described in a booklet available from Master Builders Co., Cleveland 3, Ohio. The title is "The Masterplate 'Iron-Clad' Concrete Floor."

A catalog of Levelimeter instruments made by Fischer & Porter Co. is available from the company at 75 County Line Road, Hatboro, Pa. The 24-p. booklet illustrates and describes instruments which indicate, measure and control liquid levels. Large flow rates are measured by the use of weirs and flumes.

Copies of "Operating Experiences With Resin Zeolites on the Hydrogen Cycle" by V. J. Calise, technical director of Graver Water Conditioning Co., are available from the company's Dept. 110, at 216 W. 14th St., New York 11, N.Y. Reports on the use of water softening ion exchangers operating on the hydrogen cycle, with acid regeneration, are relatively new to this field.

"Koppers will handle the coating job from *start to finish.*"



• On water and sewage projects, it's sound, long-range planning to turn the job of protecting the steel pipe over to Koppers Contract Department. Koppers' trained protection specialists will handle the job from start to finish.

Koppers furnishes skilled workmen, competent supervision and special equipment to coat your pipe lines inside and out with Koppers Bitumastic* Enamel.

This *permanent* protective coating is processed from coal-tar pitch, a substance that has outstanding records in the battle against corrosion. Inside the pipe, the Bitumastic spun lining prevents rust and tuberculation and guards against the attack of sewage gases and acids. The Bitumastic exterior coating protects the pipe against moisture, corrosive soil and electrochemical reaction.

For long-lasting protection against corrosion . . . for a job done right from start to finish . . . call on Koppers Contract Department.

*T. M. Reg. U. S. Pat. Off.

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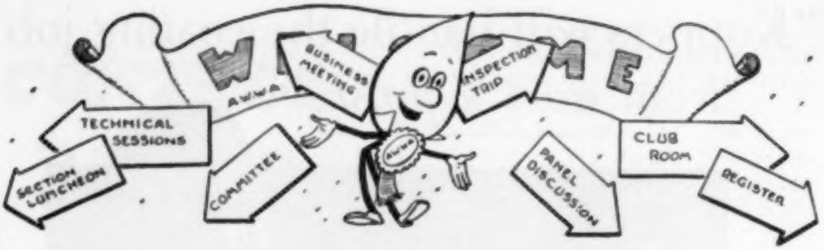
KOPPERS

BITUMASTIC ENAMELS



Section Meeting Reports

Ohio Section: The eleventh annual meeting of the Ohio Section was held at Dayton's Biltmore Hotel on November 3 and 4, 1949, with a total registration of 308.

On Thursday, November 3, the General Session was begun with the presentation of "Essentials of a Good Small Water Works" by Carleton S. Finkbeiner of Toledo. A panel discussion entitled "Lapses in Water Quality" was conducted by H. P. Cowgill and included discussions by D. P. Griffin, W. R. Wagoner and W. E. Spies—all of the State Dept. of Health. A film entitled "Public Relations at Work" was then presented by John E. Kleinhenz of the Indianapolis Water Co., who also acted as narrator. The session closed with a paper on "Radioactive Disposal Problems as Related to Water Supply" by Lloyd R. Setter of the U.S. Public Health Service, Cincinnati.

The Management Session Thursday was led off by M. W. Tatlock, whose provocative title was "Are Your Water Rates Adequate?" A panel on "Increasing Efficiency of Meter Reading" led by Wendell R. LaDue featured contributions by J. P. Reinheimer of Springfield and E. E. Smith of Lima. Wylie Davis of Cleveland Heights asked the rhetorical question "When Should Meters Be Scrapped?" and his comments were discussed by L. W. Bausher of Akron.

"Main Sterilization Procedures" were described by A. E. Griffin of Wallace & Tiernan Co. John Peurifoy of Hamilton offered a statement of policy on "Surplus Water Sales." A film entitled "Underground Arteries" was then shown by courtesy of Johns-Manville Corp. A paper by Leslie P. Sharpe of Struthers entitled "Emergency Communications Between Office and Field" concluded the session.

The Purification Session was begun with "Treatment Problems in Small Water Plants," presented by O. F. Schoepfle of Sandusky and discussed by M. L. Riehl of Columbus. Kenneth E. Damann of the U.S. Public Health Service, Cincinnati, discussed "Microorganisms in Water Supplies."

"Safety in and Around the Plant" was offered by Homer Knox of Columbus and R. W. Campbell of Lorain took the topic "Cleaning or Re-

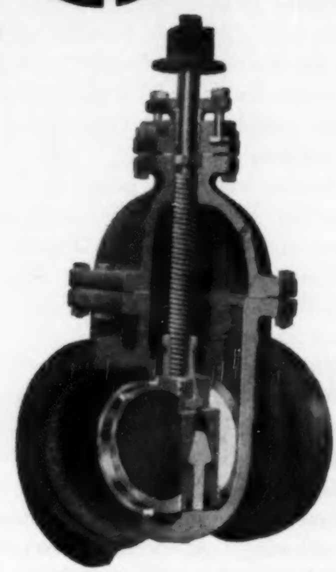
(Continued on page 74)

Water and Sewerage Works Materials, Catalog 34.

Fire Protection Materials, Catalog 40.

HIGH EFFICIENCY LOW MAINTENANCE

M H HYDRANTS and VALVES



Hub Ends, Mechanical Joint, Flanged or Universal

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M & H Products Include—

FIRE HYDRANTS
GATE VALVES
WALL CASTINGS
SPECIAL CASTINGS
TAPPING SLEEVES AND VALVES
CHECK VALVES
FLOOR STANDS
EXTENSION STEMS
SHEAR GATES
MUD VALVES
VALVE BOXES
FLAP VALVES
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FLANGE AND FLARE FITTINGS
FLANGED FITTINGS
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CUTTING-IN TEES

HYDRANTS: Standard A.W.W.A. type. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. Special Traffic Model is designed to yield under impact and be repaired by renewal of breakable bolts and coupling.

VALVES: A.W.W.A. type, iron body, bronze mounted with double disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with spur or bevelled gear and hydraulically operated. Also Square Bottom and Low Pressure valves.

M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

(Continued from page 72)

placement of Filter Sand and Gravel." C. O. Hostettler of Akron spoke on the new "Versenate Method," comparing it with other hardness-determining procedures. D. D. Heffelfinger of Alliance discussed "The Operators and the Consulting Engineer."

On Friday the General Session heard Kenneth S. Watson of the Ohio River Valley Water Sanitation Commission speak on "Progress on Pollution Problems Under the Ohio River Compact," after which Homer Knox of Columbus discussed "General Pollution Problems." "The Value of Standards to the Water Works Industry" was discussed by A.W.W.A. Secretary Harry E. Jordan (*see* January issue, text p. 93). A. V. Agnew of Lorain presented "Emergency Connections—Intercity and Industrial," after which A. S. Hibbs of Chillicothe discussed the topic.

"Inventories for Mutual Benefit" was the title of a paper by Jack Bayless of Chagrin Falls, and Harry H. Moseley of Cleveland described the "Design Features of the Nottingham Intake." R. S. Banks of Marysville offered "Softened Water Evaluated," additional comments being presented by Paul Laux of Columbus. "Dayton's New Water Plant" was described by W. W. Morehouse of that city.

The Management Session featured a panel on "Financing Main Construction" which was led by Philip Burgess of Columbus and included E. E. Hagerman, Dayton, and Paul D. Cook, Painesville. J. E. Gotherman discussed "Illegal Demands on Department Funds" and the session was concluded with Carl Eberling's presentation and W. W. Morehouse's discussion of "Emergency Shutdowns."

The final session—Purification—was devoted to Robert E. Shoup's description of "Recarbonation at St. Marys" and a panel on free residual chlorination and tastes and odors, in which L. A. Marshall led the discussion and E. B. Evans and Paul Laux participated.

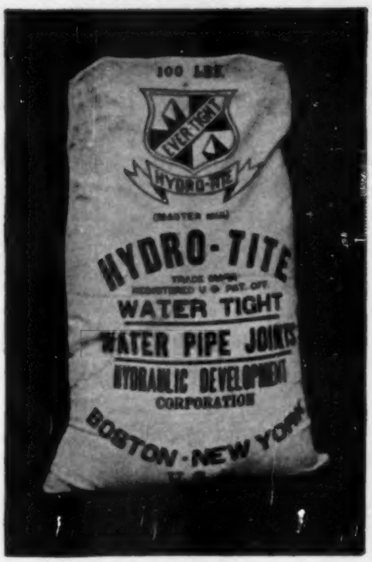
Social events included a ladies' luncheon on Thursday and Friday and a cocktail hour, by courtesy of the manufacturers, which preceded the Section Banquet Thursday evening. A special entertainment feature of the banquet was a boxing show put on by the Dayton Boys' Club. The audience enthusiastically took sides and cheered on its favorites in each of the age classes, which ranged from 6 to 16.

The Wendell R. LaDue Citations were presented to those who earned them "For sustained interest in water works affairs as evidenced by 20 years or more of continuous active membership in A.W.W.A." Those honored included Philip Burgess and A. G. Levy in the 35 year or over group; Charles P. Hoover and F. H. Waring, 30 years; J. W. Ellms, J. S. Gettrust, L. A. Marshall, I. W. Mendelsohn and G. N. Schoonmaker, 25 years; and 28 others in the 20 year group.

F. P. Fischer
Secretary-Treasurer

(Continued on page 76)

HYDRO-TITE



TESTED FOR OVER 30 YEARS

For more than thirty years water works superintendents have been using Hydro-tite for joining bell and spigot pipe. They have found that this self-caulking, self-sealing compound costs less to buy, requires less labor, makes tighter joints and withstands the effects of time, strain and vibration. Send for data book and sample.

Always use Fibrex, the bacteria-free packing for pipe joints. Send for sample.

HYDRAULIC DEVELOPMENT CORPORATION

Main Sales Office: 50 Church St., New York, N. Y.

Works: West Medford Station, Boston, Mass.

(Continued from page 74)

North Carolina Section: The annual joint meeting of the North Carolina Section and the North Carolina Sewage Works Assn. was held November 7–9, 1949, at Highland Pines Inn, Southern Pines, N.C. The total registration, including members and guests, was 226.

Registration began on Sunday afternoon, November 6, and the technical session was opened Monday morning by a cordial address of welcome by C. N. Page, Mayor of Southern Pines. The technical session, which was presided over by Chairman R. W. Luther, was begun by George S. Moore, superintendent of the Albemarle Dept. of Public Utilities, who presented a paper on "Experiences in Extending City Limits." A paper entitled "This Business of Water Supply and Sewage Disposal—Today and Tomorrow," which had been prepared by A.W.W.A. Vice-President W. Victor Weir, was presented by Linn H. Enslow, Editor, *Water and Sewage Works*.

After luncheon, the program consisted of panel discussions. The first, on subjects relating to water supply problems, was led by Stanford E. Harris, superintendent of Winston-Salem. The members of the discussion panel presented short papers and led discussions from the floor. The subjects and authors were: "Water Main Joint Materials" by J. W. Dandridge, consultant of Piatt and Davis, Durham; "New Main Sterilization and Testing" by J. W. Setzer, Gastonia Water Dept.; and "Testing, Cleaning and Disinfection of Wells" by W. S. McKimmon of the State Board of Health.

The morning session on November 8 was opened with a paper entitled "Water and Sewage Practices in Europe" by C. E. Perkins, Winston-Salem city manager. It was followed by a paper on "Experiences With Fluoridation" presented by R. S. Phillips of the Charlotte water department. The remainder of the morning was consumed by a talk given by Frank E. Hale, retired laboratory director for the New York Water Dept., on the subject of "Historical Reminiscences," and a paper entitled "Contamination of Water With Radioactive Substances" presented by Arthur E. Gorman, Atomic Energy Commission.

At the honorary luncheon for national officers and guests, addresses were given by A.W.W.A. Secretary Harry E. Jordan and Ralph E. Fuhrman, Vice-President, F.S.W.A. The luncheon was followed by the Annual Business Meeting at which new officers for the ensuing year were elected and committee reports were presented. The remainder of the afternoon was left open for inspection trips to the slow sand filter plant at Pinehurst and other activities of interest.

The annual banquet was held on Tuesday night with C. E. Perkins presiding. The Maffitt Membership Cup was awarded to Thad C. Burnett, superintendent of watersheds, Asheville, for obtaining the greatest number of new members for the section. W. D. Carmichael Jr., acting president of

(Continued on page 78)


Brass Goods for
Water Service
Gas Service
Fire Protection
J
JAMES
JONES
COMPANY
LEROY AND ST. JOHN STREETS
LOS ANGELES 12, CALIFORNIA
Write for catalog "J"
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(*Continued from page 76*)

the University of North Carolina, delivered the principal address of the evening.

The program Wednesday morning was devoted to papers on subjects relating to stream sanitation. The papers presented were: "Industrial Use of Streams—A Second Look" by L. L. Hedgepeth, American Cyanamid Co.; "Federal Government's Activities in Stream Pollution Abatement" by Louis A. Young; and "Studies of Increased Air Application in Sewage Treatment" by W. G. Brown.

Clubroom entertainment was provided by the manufacturers, and, as in the past, it was quite popular and splendidly handled by the clubroom committee.

E. C. HUBBARD
Secretary-Treasurer

Southeastern Section: The annual meeting of the Southeastern Section was held in Albany, Ga., December 5, 6 and 7, 1949. The total registration was 161, which included water works personnel, manufacturers' representatives and guests.

The meeting was called to order by T. A. Jones, Chairman. The opening prayer was given by Dr. L. A. Stephens, and was followed by an address of welcome from J. W. Smith, mayor. The response to the mayor's cordial welcome was given by T. A. Jones.

F. B. McDowell, manager-engineer, Commission of Public Works, Charleston, began the technical program with "Water Works Reports to the Public." A lively discussion followed the presentation, led by Paul Weir of Atlanta in the absence of T. E. P. Woodward.

Following the morning session, everyone was invited to attend a barbecue at Chebow Park as guests of the city. Following this enjoyable meal, a conducted tour of nearby Turner Field was made by most registrants present. The workings of the new jet planes were explained and a demonstration of these planes in flight was given. The only disappointment in this tour was the fact that the planes could not take passengers.

Tuesday morning's session started with an excellent talk on "Public Relations" by Paul Weir, General Manager of the Atlanta Water Works. F. W. Chapman presented the many problems confronting water works superintendents in municipalities where water works funds are diverted to the city treasury. He discussed the fact that diversion of funds is similar to a sales tax and as such should be shown on every bill so that the customers will know and understand where their money is going. The talk was ended on a very pertinent question: "How about paying a regular tax assessment?" J. L. Arnold presented an excellent discussion of this topic, explaining that although Albany was guilty of this practice, the people of the community were aware that the profits from the utilities are used for

(*Continued on page 80*)

FOR *Positive Operation*

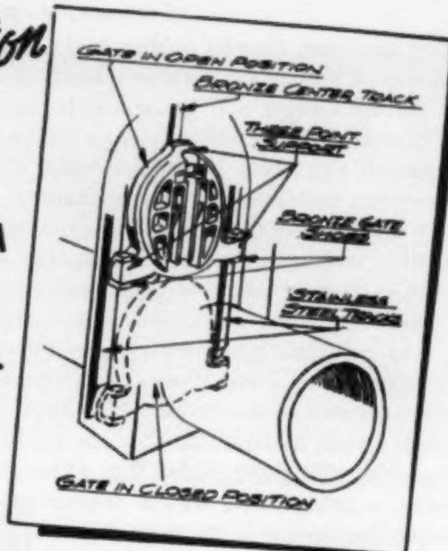
RENSSELAER

SQUARE BOTTOM GATE VALVES

have 3-point gate support

moving on

STAINLESS STEEL TRACKS



Designed for longer life under severe operating conditions, this was the pioneer valve supporting the downstream gate in THREE places at EVERY point in its travel. In its full length of travel this gate is smoothly guided by the lower supporting lugs sliding on STAINLESS STEEL TRACKS. The center track, for the top lug, is bronze.

This constant three-point support means eliminating any tendency of the gates to tilt when partly open and score or wear the face of the seat ring.

Another feature – during entire operation, the gate ring is held completely free from contact with the seat ring, by the tracks, until near the closing point. Then the tracks taper and allow contact between gate and seat, minimizing wear.

Recommended for emergency shut-off, frequent operation, throttling service and vertical pipe lines.

● *Without obligation on your part, a Rensselaer representative will be glad to give you the benefit of his experience in Valves, Hydrants and other Rensselaer products. Call our nearest office.*

WHAT 3-POINT SUPPORT MEANS

1—*Valve closes easily under high differential head.*
2—*Valve operates frequently without excessive wear.*
3—*Valve can be used for throttling without damaging seat rings.*
4—*The gates are properly supported for operating in vertical lines.*

LEADERSHIP FOR OVER 65 YEARS

RENSSELAER

Gate Valves • Square Bottom Valves • Tapping Valves and Sleeves
Hydrants • Check Valves • Air Release Valves

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(Continued from page 78)

other functions, thereby holding taxes to a minimum. As expected, there was also a very lively discussion from the floor.

In the absence of F. L. Arnold, his paper on midges and bloodworms—"Those Horrible Monsters"—was presented by T. A. Kolb. This paper explained that there is no established control for midge larvae in open reservoirs, and although they actually have no public health significance, they are a definite hazard to public relations. P. J. Philson, in his discussion, emphasized control measures. Since unreasonable amounts of chlorine, copper sulfate or other disinfectants are necessary to destroy the "bloodworms," the only remedy is draining and scouring the infected basins.

Lowell Cady presented a highly informative discussion on "Costs and Construction of Water Works Improvements in the Southeast." Construction costs today are extremely high when compared with costs in 1936, but recent trends indicate that they are gradually decreasing. E. E. Bolls, in discussing this paper, stated that, although construction costs may be high today, a utility faced with a definite need for improvements should not jeopardize service in the hope that construction costs will be lower in the future.

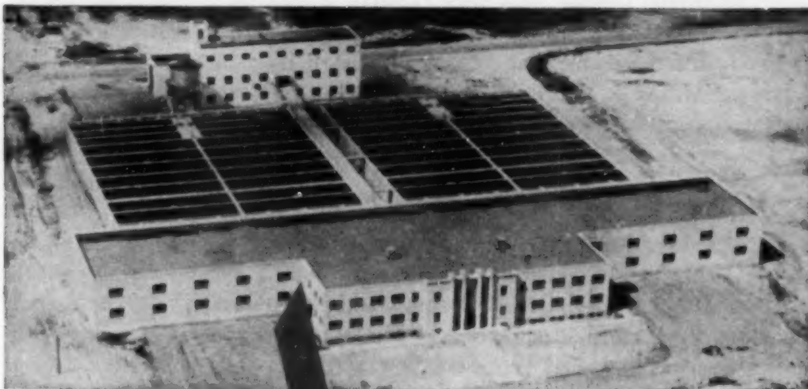
John Purser presented an informative, as well as educational, discussion on the "High Cost of Operation at Reduced Pump Efficiencies." He stated that it was necessary to keep strict vigil to see that the pump efficiency is not reduced, that it is economically profitable to install pumping units with high efficiencies and very thrifty to see that these efficiencies are not reduced. Lewis Simonton, in his discussion, emphasized the importance of proper maintenance, and, in order to assure that a pump is operating at its designed efficiency, the keeping of daily plant records of hours in service, electricity consumed and total amount of water pumped.

E. C. Matthews discussed fully "Accounting Procedures in Water Works," emphasizing the importance of reducing office costs. Other factors than the accounting system enter this picture, such as improvement in personnel methods, better office health, training programs and improved furniture with better space allotment.

C. H. Coward of Remington Rand, Inc., commented that the meter is the cash register of the utility, that earnings or lack of them depend on the cash register and therefore we should all be interested in all records relating to the meter.

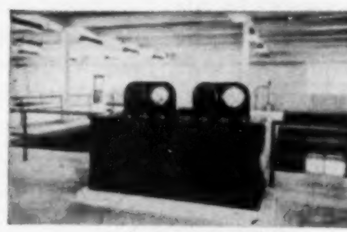
W. H. Weir discussed the Georgia Water and Sewage School, describing the start of this school and how it has expanded and attendance increased in the 18 years it has been in existence. Further, short schools have been established as an essential part of the entire effort to maintain public water and sewerage service at a high degree of efficiency. W. T. Linton, in discussing this paper, explained the operation of the short school in South Carolina, and ended with a very serious question "Where Are We Going?"

(Continued on page 82)

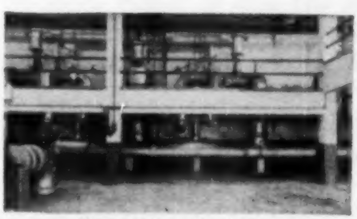


New 40 m.g.d. Filter Plant at the City of Savannah, Georgia.
Consulting Engineers:—J. E. Sirrine Company
General Contractors:—Virginia Engineering Company

AGAIN it's
ROBERTS FILTER
SAVANNAH, GEORGIA



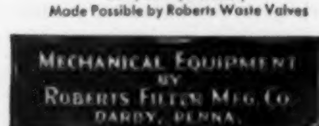
Roberts Operating Tables



Upper and Lower Pipe Gallery

Compact Pipe Gallery
Made Possible by Roberts Waste Valves

View of Operating Floor



ROBERTS FILTER
MANUFACTURING CO.
630 COLUMBIA AVENUE • DARBY, PENNA.

(*Continued from page 80*)

The annual banquet was held Tuesday night with 212 persons attending. An excellent program of entertainment was presented, including an orchestra for the dance that followed, through the courtesy of the city of Albany. Mayor J. W. Smith acted as Master of Ceremonies, introducing the various acts as they appeared.

T. A. Kolb
Secretary-Treasurer

Cuban Section: The Cuban Section, meeting at Havana on December 15–17, 1949, drew a generous complement of 30 Latin-American visitors together with a few from the U.S. mainland. Including 35 Cuban Section members, the total in attendance was 71. After an address of welcome by Carlos Maruri, personal representative of the alcalde (mayor), visiting Florida Section Chairman S. K. Keller and local Chairman Luis Núñez responded.

The technical papers were begun with "The Present and Future of Cuban Water Works" by Manuel J. Puente, and "Sanitary Protection and Conservation of Artesian Wells in Vento by Almendares River Dam," presented by Abel Fernández Simón and Rafael Gómez Calás. On Friday Ernesto E. Trelles spoke on "Improvements and Sanitary Control of Vento Water Works." Juan A. Cosculluela discussed "Water Hydrology and Bacteriology in Cuban Water Supplies," and was followed by Jesús M. Valdés Roig, whose topic was "Financing Water and Sewage Plants in Cuba."

"Pumps Used in Domestic Service" was the subject of a graduation thesis presented by José García Bengochea, and Luis A. Núñez spoke on "Water Hammer at Marianao Pump Station." A full discussion followed each of the papers presented, and all participated in the general exchange of views.

The last day of the meeting featured an inspection tour of work in progress on improvements in the Havana Water Works, and a luncheon.

New York Section: The Annual Midwinter Luncheon Meeting of the New York Section, held in honor of the visiting directors of the A.W.W.A. at the time of their annual meeting, took place at the Statler Hotel, New York City, on Tuesday, January 17, 1950. There were present 300 members, directors and visiting members of the American Society of Civil Engineers who were also holding their annual meeting in New York.

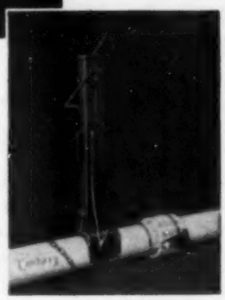
As has been the plan at the Midwinter Meetings, the program avoided too technical subjects and featured current topics of interest. The main speakers were Leo Wolman, head of the Economics Dept. of Columbia University and brother of our well-known Abel Wolman; and Edward J. Clark, chief engineer of New York City's Dept. of Water Supply, Gas and

(*Continued on page 84*)

STRAIGHT LENGTHS MAKE A RADIUS

Easy does it with K&M "Century" ASBESTOS-CEMENT PIPE

Note the radius, with strictly standard pipe and couplings.



Note the sure, simple, fast way to make tight joints for straight lines or radius.

5 DEGREE deflection at each pipe joint is perfectly safe and simple in laying K&M "Century" Asbestos-Cement Pipe with "Century" Simplex Couplings (made of identical material). Offsets may go to 13 inches per standard 13-foot pipe length. With shorter straight lengths even the sharpest practical radius is easy. Nothing special is needed.

Such simplicity underscores the economy of laying this K&M pipe—inexpensive to haul—light to handle—easy to cut on the site. Continued economy comes from high resistance to soil corrosion and immunity from tuberculation and electrolysis. The initial high flow capacity cannot be reduced by tuberculating waters.

Highly resistant to the stresses of traffic and earth settlement, as well as to chemical deterioration, K&M "Century" Pipe actually gains strength as it ages. It is recoverable for re-laying in its original pressure class! Here is low cost—lastingly. Write us for full data.

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K&M best in asbestos

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(Continued from page 82)

Electricity. Prof. Wolman in his usual effective manner analyzed the national budget in a very interesting way, pointing out the pitfalls of deficit financing encountered by other countries which have adopted unbalanced budgets.

Chief Engineer Clark presented directly to the members and guests the current problem of the severe water shortage now being experienced in New York City. He paid a heartfelt tribute to the press, the radio and television of New York for their splendid cooperation in reducing the waste and general consumption in New York during this emergency. He also outlined very clearly the reasons for the water shortages here, observing that the rainfall has been lower than ever recorded before. In addition, the long-term program started in 1930 was delayed by a number of factors: litigation over water rights, the depression of the early '30s and, finally, World War II—all of which were beyond the control of the various authorities on long-time planning.

A.W.W.A. Pres. A. P. Black very interestingly, as usual, discussed the work and accomplishments of the Association throughout his able administration.

R. K. Blanchard
Secretary-Treasurer

Ellis Bell End Test Clamp

Photo shows Clamp on 8" pipe

THOUSANDS IN USE

For testing mains; temporarily closing mains for the night, on account of fire; or for closing branch openings temporarily; and in any emergency where you wish to plug the pipe for a period of time, the Ellis Clamp has no equal. Holds pressures up to 300 pounds, and more.

This clamp is for use on bell end of cast iron pipe of 4", 6", 8", 10", and 12" sizes.

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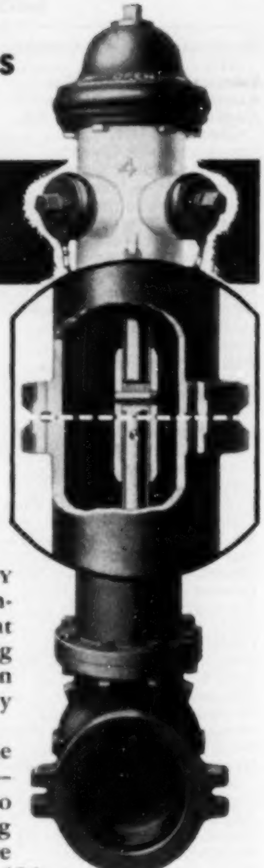

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As tough as they come . . .

but when it breaks, it's as clean as a whistle . . . at ground level.

yet, it's back in service in twenty minutes.

The safety breakable section of a KENNEDY Safetop Fire Hydrant will take all the punishment that a standard one-piece hydrant will. But when a couple of tons of flying steel hits it at high speed—and it's more than any hydrant can take—it breaks cleanly and evenly at ground level.

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Where there is no traffic hazard install a KENNEDY Standard Hydrant with 1-piece standpipe and stem

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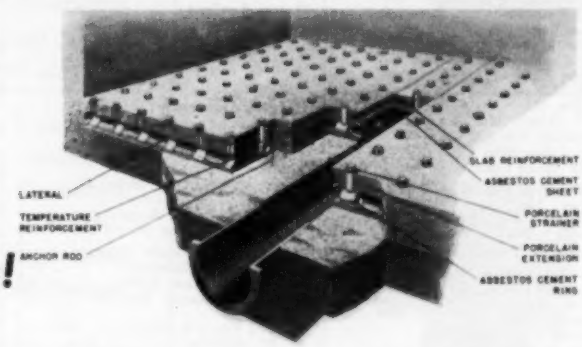

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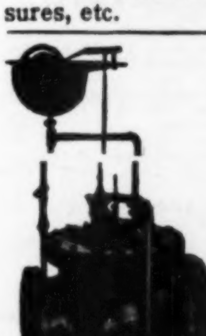

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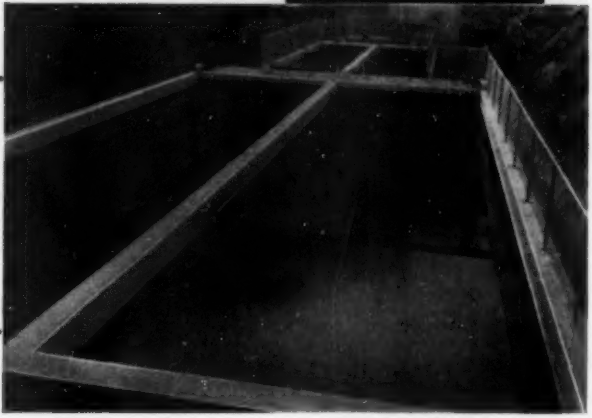

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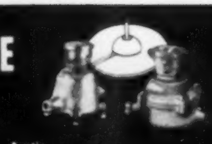

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Saves at least 75%

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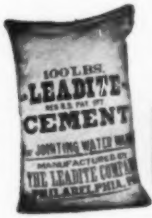

No Caulking